



The
Small Computer
Magazine

kilobaud^{T.M.}

Understandable for beginners . . . interesting for experts

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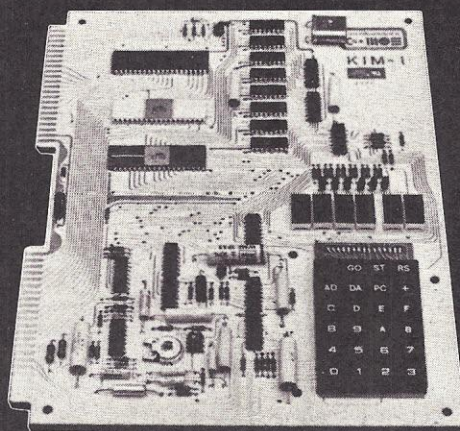
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PUBLISHER'S REMARKS

Wayne Green

The French Do It Again

A letter from W3NET included a reference from a navy-published book, and it covers the history of Teletype codes. The upshot of all this is that the five-level code we've been using all these years is not Baudot at all . . . it is the Murray code, developed by Donald Murray around 1901. The Baudot code is entirely different . . . though still a five-unit code. For instance, in case you don't want to believe me, the letter R in Murray is 2 & 4. In Baudot, R is 3. In Murray code, the uppercase R is the number 4. In Baudot, uppercase R is a hyphen. Convinced? Murray code is also known as the International Telegraph Alphabet No. 2.

It's time to change to ASCII and bury this whole mess.

Spadework

There it was! Right by the ramp leading to the United Airlines plane at Logan (Boston) I saw this kiosk with a PolyMorphic microcomputer . . . all set up and running. It was put there by the Computer Shop of Cambridge and must have cost a bundle. I hope it draws some business for them.

Just to be sure, I called Bob Rivers at the Computer Shop and asked him how effective the kiosk was. That's awfully expensive



advertising, so it would have to pull a lot of customers to be worth the expense. Bob said that they had renewed their contract for the space, if that told me anything. It sure did.

When we were pricing displays for promoting Computermania, we checked on the cost of the billboards at the airport . . . hoot mon! They cost a couple hundred dollars a month each . . . just for the billboards . . . so I'm afraid to even speculate what a kiosk like that runs.

It's located where every passenger has to go right past it, so the visibility is high. There are some brochures available to help people remember the name and address of the store . . . and a rough outline of what they are selling. This is tremendous promotion for microcomputing.

The airline magazines are running a special computer section in June, so keep your eyes open if you are traveling to NCC or the Atlanta Hamfest/Computerfest.

The Second Faïre

The San Jose Computer Faïre was enjoyed by just about everyone. It was packed with people and there were many more prospective exhibitors than space for exhibits.

Many exhibitors mentioned that there seemed to be a lot less room than there had been last year at San Francisco . . . room for fewer exhibits . . . and tiny aisles which quickly filled up, making it very difficult to get around.

A check with a Convention Facilities Directory showed us that San Francisco had 37,000 square feet in the main room and 30,000 more in the two side rooms, for a total of 67,000 square feet. The San Jose hall had only 30,000 square feet . . . plus about 2000 more for the micro-booths in a separate room. No wonder it seemed so crowded . . . it was half the size of the San Francisco Civic Auditorium.

A rough calculation of the aisle space showed about 11,000

square feet. When a density of one person per ten square feet is reached, an exhibit hall is generally considered full, and it is difficult for people to move around. This leaves room for elbows and a bag of literature, but not much more. At times the show reached this density in the more popular spots, indicating a possible head count of 1100 in the aisles.

That may seem a bit scant in view of the interesting numbers announced by the Chairwhat-ever, but I like to check little nit-picking items like this, so every so often I would take a quick run down a few aisles, counting the feet and dividing by two. There were seven aisles in all, with four of them shortened by the cut-off corners of the hall. This shortening just about made up for the space in the three cross aisles. My counts confirmed the approximately 1000 attendance figure during the more crowded times.

When the crowd density gets to five square feet per person, there is no longer room for elbows or much arm movement, and shuffling around is quite difficult; and this could account for a total of up to 2200 people in the exhibit aisles.

With 150 exhibits to see and a total of 1500 minutes of show time, maximum, no one could spend more than an average of ten minutes per booth and see the whole show. The attendance was scant on both Friday and Sunday mornings, so very few people managed to get in the entire 1500 minutes. The familiarity of the faces by Sunday indicated that a lot of people did come all three days and made an effort to see all of the exhibits.

Each person who got anywhere near the *Kilobaud* booth was asked to fill out a questionnaire which would be entered in a drawing for a Caribbean cruise. Few passed up the opportunity. By Sunday we found that most of the passersby had already filled in a card, indicating a high percentage of show-goers coming back for a second and third day to see the exhibits.

Though it's possible that a few people managed to see the show and not get near the *Kilobaud* booth, this is unlikely. Our count on the filled-out cards, after sorting out the duplicates (some people try to increase the odds on these things), came to 4100.

A check with several exhibitors who were handing out literature indicated that some had handed out over 3000 pieces . . . others claimed close to 5000.

Software Needed

I don't think there was one manufacturer or dealer who didn't express the universal cry for programs. Hobbyists have been spending a lot of money on hardware, but so far there has been very little they could do with their expensive systems except play *Star Trek*, *Submarine*, *Mastermind* and so forth.

The *Kilobaud* plan for distributing software was enthusiastically embraced by everyone . . . now all we have to do is get it going. We do have the staff and the equipment to get this project running, so I hope the first programs will be coming out in the next few months. Programs for the TRS-80 and PET will be out on cassettes. We have a first-rate lab for checking out programs, a superb cassette duplication system for bulk production of cassettes, the publishing facilities for printing documentation, the sales force and list of dealers to distribute and an international rep organization to get us into every country.

Programmers can do a lot worse than get in touch with *Kilobaud* about publication and distribution of their programs. They must be complete and ready to go, with thorough documentation. The deal is simple: 20 percent royalty on our receipts. This is about five times the going rate, and we hope that we can establish this as a norm for this field by starting it out that way and maintaining this percentage.

What kind of programs are needed? Just about anything for the TRS-80 can be instantly distributed. At present the programs should fit the 4K systems, but it won't be long before we'll be needing most programs to work with the 16K systems. Almost anything will go for the PET too . . . 8K systems.

In the long run we will be able to do best for programmers who work on what we call vertical systems. These would be program packages that would enable computer stores to sell complete systems to specific businesses. Let's say a programmer has a good friend who runs a moving-van service. I picked that at random by opening the Yellow Pages. He would then consult with his moving friend and develop a program package that would do everything a moving-van firm could want . . . everything.

Once the package was done and carefully checked with a couple local van firms for accuracy and completeness, we would

package it and sell it through computer stores. Stores would take the package, set it up to work on a system and then call van firms to come in and see it at work. It is unlikely that many would pass up the system. When you consider that there are over 80,000 such firms around the country, you can see that sales could be vigorous.

There are hundreds of vertical packages that can be developed to help computer stores with their sales . . . and these should bring in handsome royalties.

Next we come to computer-aided instruction . . . and the possibilities for thousands of more programs. Every course taught in school—and those that should be taught in school—are good prospects for this field.

Home-oriented programs will be popular . . . security programs, general business programs, games . . . the list is, fortunately, endless.

Programs that are usable on more than one system will be checked out on other systems in the *Kilobaud* labs . . . we have most of the microcomputer systems set up for this . . . and even our maintenance man is into working up programs. Of course we have the TRS-80 (16K), the PET, Altairs, Imsai, OSI, ISC, Heath H8 and H11, etc. This place is microcomputer heaven.

Programmers should send in complete listings, documentation, some data on how to use the programs and what they can do . . . plus a cassette or disk with the program on it, depending on the system. We would like to get as good a print of the program as possible.

Programmers interested in tackling a major programming package would do well to register with us. This could prevent ten programmers from working up very similar dental programs, for example. Tell us what you are planning to put together and we'll let you know if anyone else is working on something similar. Packages will be chosen on the basis of excellence, not first come.

Very Rich Programmers

We feel it is in the interests of the whole industry that programmers get a major piece of the action. The ability to sell microcomputer systems rests on the excellence of the programs . . . more so than the hardware . . . so why not make it possible for programmers to benefit accord-

ingly? Our system should make it possible for programmers to get rich beyond their wildest dreams.

Suppose we come up with a hot moving-van package . . . and sell it for \$995 to the customer. This would wholesale to the dealer for \$597 (40 percent off). The rep would get 10 percent, leaving a net sale of \$537.30. Twenty percent of that would come to \$107.46. If only 10 percent of the van firms bought the system, this would net the programmer \$859,680 (before taxes). I suspect that sales will be more like 75 percent of the industry than 10 percent, but why build the pie factory in the sky? A 75 percent sale would bring in about \$6.5 million in royalties.

Is \$995 a little high for such a package? The customer would be buying about \$15,000 or so in hardware to go along with it, so it would really be miniscule . . . running less than \$25 a month!

What about my plan for \$7.95 software? Oh, we'll have a lot of that. The programs for games, for homes, general programs, teaching programs, these will be of interest to much wider interest groups, and we can look for sales in the millions of these programs. Most of the TRS-80 and PET programs will come in this category . . . at least until the hardware is available for business use of these systems.

Are you still reading and not rushing to your computer to program? You need some All-Bran . . . badly.

The Kilobaud Lab

As soon as the TRS-80 and PET are brought into the system we'll have one of the most extensive microcomputing systems

anywhere. On line at present are two Altairs, an Imsai, an Ohio Scientific Challenger, a Heath H8, an H11 and five Computecolors. Peripherals on line are a Centronics 51 printer, a G.E. Terminet, a Teletype, an OSI disk, two Altair disks, a North Star disk, the H10 and H9, the SWTP CT-64, a Computalker, a clock module, the Heuristics board, an S.D. Sales Z-80 etc.

Barry, our tech, is working to I/O all of this to our Prime mini-computer system as well as the TRS-80 and PET. This will enable us to check out submitted programs on just about everything popularly available . . . lacking only a 6800 system.

In addition to our wanting to know personally how all the various systems work, another reason for all this hardware is to give us the ability to produce programs for sale . . . and be sure they all work on the systems we say they will.

What's Coming?

Initially we'll be putting out programs on cassettes. After that we'll probably be using more and more disks, then perhaps ROMs; but what will be next?

With the prices on video recording systems coming down, we may soon see video recorders used for program and data storage. These recorders are all set up to be easily controlled by a computer.

Picture, if you will, a study course of the future . . . on videotape. It will have full television action and sound in color . . . and program your computer as it goes along. It will show material and then stop and ask a question about what has been

Reader Responsibility

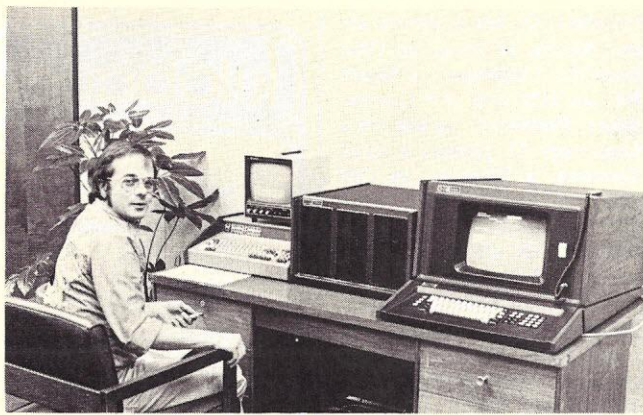
One of your responsibilities, as a reader of *Kilobaud*, is to aid and abet the increasing of circulation and advertising, both of which will bring you the same benefit: a larger and even better magazine. You can help by encouraging your friends to subscribe to *Kilobaud*. Remember that subscriptions are guaranteed—money back if not delighted, so no one can lose. You can also help by tearing out one of the cards just inside the back cover and circling the replies you'd like to see: catalogs, spec sheets, etc. Advertisers put a lot of trust in these reader requests for information. To make it even more worth your while to send in the card, a drawing will be held each month and the winner will get a lifetime subscription to *Kilobaud*!

Reader-service card submission is on the increase, so we had plenty to draw from. Winner of a lifetime subscription to *Kilobaud* is Fred Schild of Playa Del Rey CA. Congratulations, Fred.

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This is the latest Extensys system. It is approaching the top end in performance microcomputers . . . and it isn't cheap, either. This is an excellent example of how far things have gone with micros.



Here's a view of the main part of the PET production department. The front line is brand new PETs that are being checked out with diagnostic programs to make sure they work.

shown. If your answer is right it will compliment you and then go on with more instructions. If you goof, the tape will rewind and replay the part you screwed up.

How far in the future is all this? Jolt had just such a system up and running two years ago . . . using a Sony video system and Jolt microcomputer. Prices on video recorder systems are coming down; performance and availability are going up. These would seem ideal mates to our computer systems. And think of the data storage on a video cassette!

Jolt was recently bought out by MOS Technology (Commodore), so we may see some of this technology coming along sooner than we think . . . if Commodore lets the Jolt crew have a free hand.

Speaking of the PET

After the Faire, Sherry and I stayed over a couple of days in the San Jose area. We made a visit to Extensys and then went over to Commodore to see the

plant where the PET is being produced. Commodore doesn't want me to spill the beans on how many units they are turning out, but I'm sure you will be able to get a good idea from my photos. They have a big bunch of units going through the production line and then through exhaustive testing. The PETs are burned in for 48 hours at a very high temperature in order to bring on any possible failures before shipment rather than after. The small number of sets in for repairs indicates the quality control system is working very well.

How long does it take to put together a PET? From one end of the production line to the test bench it takes a little over one hour! With the large number of PETs coming out of the factory it is amazing that dealers are groaning over their back orders . . . some were telling us they could sell ten times as many as they are able to get.

The factory will be increasing its production soon, but this still won't take the pressure off. By next year, I'll bet they have a factory several times as large as they have right now.

What about Radio Shack?

On the way back from San Jose we stopped off in Dallas/Fort Worth.

The next day we had lunch with Bill Mueller of ICOM and Art Housholder of AGL Electronics in Dallas. A Mexican restaurant right near AGL was fantastic. I don't care if AGL wants to throw away their advertising money like drunken sailors in other magazines, I'll be stopping by to visit at every opportunity.

From there we waddled on to Radio Shack and Hy Siegel. Despite a broken leg, gained a



On the right of the PETs being checked out is rack upon rack of PETs being burned in. They burn 'em in for 48 hours before packing them up for shipment. Normally they have those plastic covers over the burn-in racks to make sure that the PETs are hot, thus aggravating any troubles that might otherwise turn up later.

few weeks earlier on the ice-skating rink in the center of the Tandy building shopping plaza, Hy took us all over the new Tandy headquarters building.

A few blocks away there is an enormous parking lot, serviced by a new subway system that ends in the Tandy building. This permits people to park and shop the

downtown area . . . and get to the parking lot easily. The ground floor ice-skating rink is ringed by a shopping plaza. Prominent in the plaza were a giant Radio Shack store, a Tandy Computer store and a new Tandy Telephone store.

The elevators go up to the 17th floor; from there you have to take an escalator to the top corporate offices.

While some firms are being run by uptight people who appear to be well on their way to terminal constipation, the Radio Shack crowd seems to be having a good time at their work. I was surprised at the large number of hams involved in the higher positions . . . most of whom have been reading 73 for years. I like that in a person. I've known many of the people either through Radio Shack in Boston or Allied Radio. Quite a crew!

Tandy has built two tower buildings recently . . . both about 19 floors. They have a third tower going up soon . . . 45 floors. Tandy is dominating downtown Fort Worth. Some difference from when I lived in the area about 30 years earlier and the highest point in town was the dung heap at the stockyards.

After the visit to the offices . . . some talking with various departments about prospective microcomputer growth . . . my software plans, etc., Hy took us off to the plant not far away where the TRS-80s are being made. Wow! Again, no production figures were to be let out of the bag, but you can see from my pictures that the production is not insignificant. They run the systems in for 24 hours, so you know all the sets you can see are just a part of one day's production.

It was so difficult to tear myself



Here are over 100 TRS-80s being burned in . . . and this is just one part of the burn-in area . . . which goes on and on . . . and on. If anyone tries to tell you Radio Shack isn't making a lot of 80s in Ft. Worth, tell him baloney.

away from the factory that we almost missed our plane back to Boston . . . and home.

TRS-80—Is It Any Good?

I've had letters from hundreds of TRS-80 owners . . . and talked with dozens at the recent shows, but I haven't had any negative comments yet on the system. Oh, everyone wants more memory and bigger BASIC, but they are amazed at what the 80 can do with what it has—and they are having a ball with it.

In view of this, the recent blast in PCC at the 80 is a mystery. The people at Radio Shack were numbed by the negative review . . . and as bewildered as I by it. Yes, the case for the keyboard and CPU is plastic, but it is very attractive and it resists dings a lot better than metal; and if you want to carry the system around the way most of us do, you loudly hail the use of lightweight plastic instead of boat-anchor iron. I carried my TRS-80 with me to San Jose . . . on to Dallas and back home. I sure wouldn't have done that if it had been in a metal case. What other computer system can you throw in a suitcase and take with you?

Byting the Apple

Since they were giving out free copies of *Byte* at San Jose, I stuck a copy in my flight bag to bring back. The price was just right.

On the flight, I had the choice of sitting back and resting or reading the magazine. I made the wrong choice and soon got a mental hernia over a review of the Apple II by editor Helmers.

Before reading the Helmers view of the Apple, I had the impression that it was an excellent system. Many of the computer store owners I have talked with were very enthusiastic about it, and it seemed to be one of the best selling systems on the market . . . possibly giving Radio Shack and Commodore a run for their money. The reader comments in the letters had all been very positive, so I was unprepared for the vicious attack in *Byte*.

Helmers, who, I understand, got the Apple free, may provide an object lesson for manufacturers who are feeling generous. He apparently could see no good in the contrivance. He didn't like

(continued on page 106)

EDITOR'S REMARKS

John Craig

Who Reads Kilobaud Magazine?

We not only have a reputation for being a magazine for "beginners" in this field—we flaunt it! I think we need to sit back and examine just who these "beginners" are, however. It's really very simple . . . we're all beginners to one degree or another. The person who just developed an interest in building or using a personal computer, and hasn't any background, is most definitely a *beginner*. (And speaking of that type of person: I recently heard of a company that didn't feel they should be advertising in *Kilobaud* because of this "beginners' magazine" image. What a hogwash attitude! Are they going to totally ignore that ever-increasing segment of the market?)

Those "total novice" individuals need to be examined much more closely because they're coming from several different directions and have different objectives in mind. *Kilobaud*, and every other magazine in the personal-computing field, is being bought primarily by computer *hobbyists*. Some of those other magazines purport to be aimed at the mass market . . . those millions of average middle-class Americans who will be buying home systems in the years to come.

The key phrase there is "will be buying." That market hasn't arrived yet, but it will—and, needless to say, we've all got our eye on it. But for right now (approaching the middle of 1978), *Kilobaud* is providing a lot of material for this mass market.

I've come to this conclusion as the result of recently teaching a couple of one-day courses on personal computing for the University of California. At the beginning of both courses, I opened with the comment that even though I was the editor of a computer-hobbyist magazine, I had no intention of directing myself to computer hobbyists. Those in attendance included newcomers interested in home computers, students, professional people (some in data pro-

cessing) and small businessmen. I was rather amazed at the number of times I made reference to articles in *Kilobaud* that would be of interest to those people.

These two groups were made up of end users, or the mass market, we've been talking about. If you stop and think about some of the practical applications programs we've run, hardware and software reviews, and small-business software, I think you'll see what I mean.

Many see this new mass market as being made up of people who simply want to take their new computer system home, plug it in, load a cassette program and run! I agree with that concept . . . to a point. That point is where these people begin to tire of all the "canned" programs they can buy . . . and get the itch to generate some of their own. (That's not hard to imagine because many of the younger generation will be programming the home computer to solve homework problems, and thereby exposing mom and dad to programming.) There will be another segment of these end users (most likely those with an electronics background) who will start tinkering with the system by adding new peripherals, modifications and capabilities.

Aha! You know what we're going to have then? More computer *hobbyists*! I wonder what magazine they'll be buying when they go down to their local computer stores?

Now . . . what about some of the other "beginners" reading *Kilobaud*? I hope computer stores, and readers, are directing small businessmen (under 5' 5") shopping for a system toward *Kilobaud*. We're doing our best to provide material to help them in selecting a system . . . with articles written with them in mind.

Now we get to the best part: all those professional computer engineers and programmers out there who read *Kilobaud*. You know, there really aren't that many people out there who are *experts* in every single area of this field. To put it quite simply, there are a lot of software types who are interested in expanding their

knowledge in the hardware area . . . and probably even more engineers interested in picking up on programming techniques. Those people are, of course, interested in reading *Kilobaud* for the same reason as anyone else: articles of general interest, objective hardware and software reviews, and *the ads*.

A good friend of mine recently pointed out something about *Byte* and *Kilobaud* that gave me some food for thought. He held up a copy of one of the two magazines and said, "This magazine is almost exclusively filled with esoteric, high-level articles and very little in the way of light reading material."

Picking up the other one, he said, "Then we have this one, which is filled each month with *mostly* light reading, short articles . . . and very little that you can really sink your teeth into. Two magazines: one which is too technical in content, and the other too light." He suggested that since *Kilobaud*, rather than *Byte*, could more likely balance things out, I should consider including at least one or two "heavy" articles in each month's issue. I'm inclined to agree with him . . . what about you? (Heck, this business of putting together a magazine is a snap! All you have to do is provide material that will satisfy tens of thousands of readers . . . all with varying interests!)

The Southern California Swap Meet

Got anything scheduled for July 1st? If so, get busy and cancel it . . . and don't plan to go out of town for the July 4th weekend . . . that is, if you live in Santa Barbara CA. If you don't . . . then, by all means, plan to drive there for the Southern California Swap Meet on July 1st. People will be coming from as far east as Phoenix . . . as far north as San Francisco . . . and as far south as San Diego . . . so there's no reason for *you* not to come!

Next month I'll include a map showing how to get to it . . . and a photo of the beautiful building the event will be held in. And, that's what it's going to be—an event: computer hobbyists, hams and electronics experimenters all getting together for a good time; and, without a doubt, that is the most important part.

Admission will be free . . . for buyers. Sellers can drop me a line

(continued on page 110)

AROUND THE INDUSTRY

John Craig

The following is from an official bulletin issued by the Santa Maria CA Police Department.

The DataSync Corp. was started in early 1977 by Colonel David Winthrop and advertised extensively in the national computer magazines. In late June 1977, Santa Maria CA Police detectives learned that Colonel Winthrop had used other names and had obtained driver's licenses under at least three names. Police learned that the Colonel had defrauded a Santa Maria man of

pretense thefts amounting to a quarter of a million dollars in five different states within the past four years, other local, state and federal agencies declined to prosecute him.

On February 26, 1978, Hunt, who had been serving his term at Chino State Prison, escaped from a minimum security facility.

Hunt is currently being sought by California authorities. Hunt is a white male, 6' 3", 220 pounds, with reddish-brown hair, and hazel eyes. He has worked as a TV repairman and has run busi-



The many faces of Norman Henry Hunt, Jr. (AKA Colonel David Winthrop).

\$10,000 under the pretense of designing a computer board for him, and detectives obtained an arrest warrant for Winthrop along with search warrants for his home and his business. Winthrop was arrested at his business and was held under \$100,000 bail.

A check of Winthrop's fingerprints revealed that his true name was Norman Henry Hunt, Jr., and that he had been a parole violator in California since 1965. Hunt was charged with three counts of false-pretense theft as felonies, and he entered a guilty plea to the charges. Hunt was sentenced to two years, eight months in prison on the Santa Maria charges. Although the investigation revealed that Hunt had been involved in fraud and false-

nesses marketing CB radios, computer products and jacks for trailers.

His method of operation has been to move to a town under a new identity, rent a house with option to buy and to make contacts in his field of endeavor (recently, computer hobbyists). Hunt will generally begin his operation by soliciting backing for product design from private parties. Often he will sell his qualifications so well that it is the victim's idea to ask Hunt to design a product for him.

Hunt may then start a business and solicit partners. He will rent a building, hire employees, begin a credit line with suppliers. After enough equipment has been received from suppliers on credit to

look impressive, he will apply for a bank loan to start production. He will usually go to a local bank rather than a large bank chain. If the loan is received, Hunt empties the business of its equipment and leaves the area, leaving the creditors and the bank high and dry.

Hunt also orders equipment from dealers and pays by check. He then stops payment on the checks. When contacted by a dealer about why he stopped payment, he may say that the product was defective and is being returned, and request that another unit be shipped.

When Hunt was arrested in Santa Maria, he had a loaded shotgun in his closet at home, and he may be considered dangerous.

If anyone has information that may relate to this suspect, please contact Detective Ernest L. Kapphahn, Santa Maria Police Department, (805) 922-7811, or Investigator Zeke Hernandez, Chino State Prison, (714) 597-1821.

SS-50 Bus Manufacturers Meet

All manufacturers of SS-50 bus compatible hardware met at the second Computer Faire in San Jose to discuss possible new bus signal assignments. Represented at the meeting were Southwest Technical Products Corp., Midwest Scientific Instruments, Smoke Signal Broadcasting, Gimix and The Micro Works.

It was agreed the uniformity of use was essential to protect current and future users of the bus from the incompatibility and general chaos now being faced by S-100 bus users and manufacturers. It was agreed by everyone present that any revised, or additional bus line assignments would be cleared with all concerned

before being designed into equipment. A suggestion to change the present "Phase 1" line to "Slow Memory" was made by Mr. Childress of Midwest Scientific Instruments. Several others present agreed that this was a reasonable change, since "Phase 1" was a redundant signal that could be obtained by inverting "Phase 2," which is also present on the bus. If no objections are found, this change will be considered for action by all manufacturers of the SS-50 bus to make the change official.

A discussion of possible additions, or changes, to the bus system for MC-6809 processors brought up the subject of monitor and software compatibility in these machines. It was agreed that Mr. Dave Shirk of Technical Systems Consultants, Inc., would be asked to recommend jump table addresses that would be used by all SS-50 manufacturers in these systems. This would insure that all users of this advanced processor on the SS-50 bus would be able to interchange hardware and software easily between monitors written by different sources.

Mr. Robert Lentz, president of The Micro Works, reported that he had conducted some experiments with high speed processors and that he had found no problems with crosstalk, or any need for terminations, etc., at speeds up to 3.0 MHz with a standard SS-50 bus.

The next meeting of the SS-50 Manufacturers Association will be held at Personal Computing 78 in Philadelphia. All manufacturers of SS-50 bus compatible products are invited. All users of the bus are also invited to participate in the meeting and to send any suggestions they may have to any of the above manufacturers for consideration at this meeting.



Photo 1. The complete Micro Works/Malibu system.

Intertec's **SuperDEC**

"pull out the guts & screw in the brains"



While we'll admit the difference in appearance between the DECwriter II and our new SuperDEC is difficult at best to see, the difference in performance is astounding! The SuperDEC is our new Throughput Optimizer designed to be easily installed in your existing DECwriter II teleprinter. Not only can our SuperDEC Optimizer increase the print speed of your DECwriter II by as much as six times its original speed, it also gives you the features offered only by our famous SuperTerm teleprinter. Features you couldn't get on your DECwriter until now.

You've undoubtedly already heard of our SuperTerm. It's the 1200 baud teleprinter that has been replacing DECwriters by the thousands. And while you may have purchased your DECwriter prior to the introduction of our state-of-the-art SuperTerm, you can now have all of the SuperTerm's incredible features without having to throw out your DECwriter.

With the SuperDEC Optimizer installed, you will have such nifty features as bidirectional printing, manual and automatic top of form, full horizontal and vertical tabs (addressable and absolute), adjustable right and left margins, an RS-232C interface, a double wide character set and up to 32 user programmable characters. You can also add an APL character set, selective addressing and an answer back feature at nominal cost.

The SuperDEC Optimizer is designed to replace the digital electronics in your existing DECwriter II. In less than five minutes, your DECwriter can be transformed into a SuperDEC. The SuperDEC Optimizer is completely "plug-compatible" with the cables in your DECwriter. The only installation tool required is one that we give you—a screwdriver. Just pull out the guts and screw in the brains. No special technical skills are required. And if you get bored watching your DECwriter print faster than you can read, the old digital electronics may be reinstalled in a matter of minutes. It's really just that simple.

Every SuperDEC Throughput Optimizer carries a full one year warranty on all parts and workmanship. But our commitment to excellence in service goes beyond the warranty. Intertec can also offer on-site service contracts for all of your upgraded SuperDEC equipment.

So, when you're ready to "pull out the guts and screw in the brains", contact us at one of the numbers below and we'll give you the name of your local SuperDEC dealer. He'll show you what a difference \$395 can make.

\$395.00
and
your old DECwriter

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The SuperDEC and other Intertec products are represented in these cities: Albany, NY Albuquerque, NM Atlanta, GA Baltimore, MD Boston, MA Buffalo, NY Charlotte, NC Chicago, IL Cincinnati, OH Cleveland, OH Columbia, SC Columbus, OH Dallas, TX Dayton, OH Denver, CO Detroit, MI Hartford, CT Huntsville, AL Houston, TX Indianapolis, IN Jacksonville, FL Kansas City, KS Los Angeles, CA Louisville, KY Madison, WI Memphis, TN Miami, FL Milwaukee, WI Minneapolis, MN Nashville, TN New Haven, CT New Orleans, LA New York, NY Oklahoma City, OK Omaha, NE Philadelphia, PA Phoenix, AZ Pittsburgh, PA Portland, OR Providence, RI Raleigh, NC Richmond, VA Rochester, NY Sacramento, CA Salt Lake City, UT San Antonio, TX San Diego, CA San Francisco, CA Seattle, WA St. Louis, MO Syracuse, NY Tampa, FL Tulsa, OK Virginia Beach, VA Washington, DC. International offices located in Australia, Austria, Canada, Denmark, England, France, Germany, Holland, Switzerland, Taiwan.

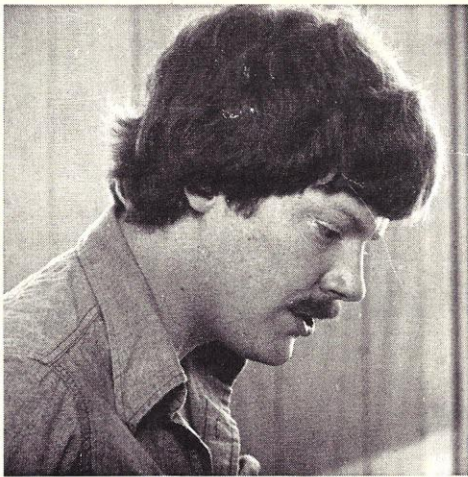


Photo 2. Bob Lentz, president and master thinker.



Fig. 1. Shannon Sherrick, daughter of the Malibu 160's designer, Mike Sherrick.



Photo 4. Larry Lowe, layout, draftsman and corporate pilot.



Photo 3. Jill Lentz, marketing, and Ann Curtis, #1 secretary.

Computer Portraits from Micro Works!

Computer portraits have fascinated me for several years, but not for the reason you might think. The electronics, the software and the hardware of the system aren't much of a mystery, or a fascination. No, I've always been amazed at the tremendous cost of such systems and knew it was just a matter of time before some enterprising micro enthusiasts came along and developed one we could all buy. Well, it's happened. Let me tell you about it. . . .

In last month's editorial I gave you an introduction to what the folks at The Micro Works are up to. They've been building S-50 6800 boards for some time now (they have an EPROM Programmer, PROM board, Universal I/O board and extender boards), but their latest is really something!

They have developed a digital video system, called the Digisec-

tor^R, which interfaces an inexpensive TV camera with a Southwest Technical Products 6800 system. The TV image is converted, by the Digisector board, into

a high-resolution digitized picture . . . and stored into the computer's main memory. So far, so good . . . and, up to now things have been *quite* inexpensive: the cost of an SWTP 6800 system, a \$200 to \$300 television camera, a video monitor for \$150, \$170 for the Digisector board and a terminal for the computer. Not too bad, right? Now we're going to have to spend a few bucks for a good high-quality printer . . . and the Micro Workers feel the Malibu 160 is the best for the job . . . and from what I've seen, I'll have to agree (catch the review on that printer in this month's *Kilobaud*).

Now, let's do a recap of the hardware, while referring to Photo 1. Going clockwise, starting on the left-hand side of the table, we have the TV camera sitting on top of the terminal (incidentally, you're going to need

some floodlights aimed at the subject), then we have a monitor for the video, the SWTP system with the Digisector sitting on an extender board (the right one), minimum of 18K of main memory and last, but not least, the Malibu printer. Add it up . . . it's a heck of a lot less than anything you've seen before! (The cost of the Digisector board includes the computer portrait software.)

Photos 2 through 6 will introduce you to the sharp team at Micro Works who put it all together . . . and Fig. 1 speaks for itself; The Micro Works/Malibu combination is a real winner! (By the way, they have an 8080/S-100 version of the board in the works, which will sell for about the same price.)

Micro Works, PO Box 1110, Del Mar CA 92014. Ph: (714) 756-2687.

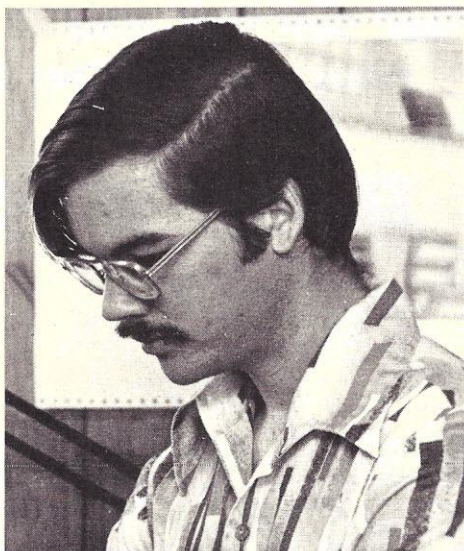


Photo 5. Andrew Phelps, senior programmer.

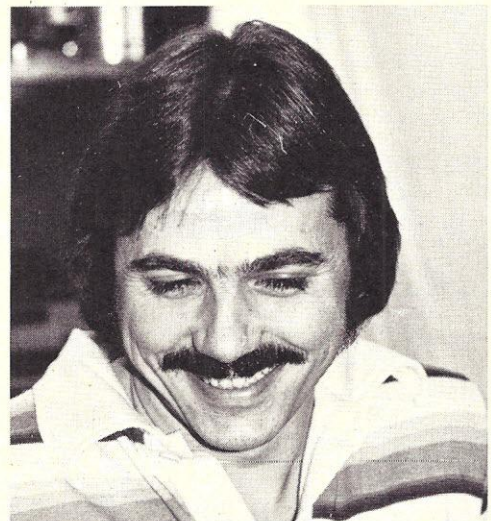


Photo 6. Bob McMann, tech writer and senior technician.

BOOKS BOOKS BOOKS

8080A/8085 Assembly Language Programming Lance A. Leventhal

Adam Osborne & Associates, Inc.
PO Box 2036, Berkeley CA 94702
\$7.50, 400 Pages

Assuming that there are other computer hobbyists who enjoy assembly-language programming as much as I do, I would like to pass on my thoughts about *8080A/8085 Assembly Language Programming* by Lance A. Leventhal.

I use assembly language in situations where BASIC won't do the job, such as graphics, input-output, or where BASIC programs won't fit due to memory size limitations. In addition to the usual I/O operations (keyboard, printer and video), I turn various external devices on and off under computer control. This requires being able to manipulate CPU registers, addresses and data lines; it takes assembly-language programming to do this.

I have written many programs, but after skim-reading this book I realized that I have missed the significance of, or misused, many 8080 instructions. A second, more thorough, study confirmed this and contributed greatly to my assembly-language programming ability.

Table 1 is an outline of the contents of Leventhal's book. Just about every possible question that you could come up with is answered in one or more of these chapters. Chapters 1 and 2 serve as the appetizer—a comprehensive discussion of assembly-language programming and assemblers.

Chapter 3 does more than just list the instructions with a brief description; a half page or more is devoted to each instruction and explicit examples promote better understanding. Nowhere else have I seen the 8080 instruction set explained with such detail and clarity.

Chapters 4 to 12 are the main course; they take you from the simple program through every

conceivable CPU operation. I found the code-conversion and I/O information especially interesting since my current project is to interface an EBCD Selectric Data Terminal to my SOL.

There is hardly a page in this book that does not contain at least one example program with source and object coding plus flowchart. These examples are really subroutines that you can use in countless programming situations.

A partial list of these subroutines might include: checksums, finding a given ASCII character, changing the parity of a string of characters, ASCII-to-decimal conversion, addition, subtraction, multiplication, division, sorting, indexing a table, code conversion and so much more. In fact, the emphasis in chapters 5 to 12 is on subroutines that can be combined to form more complex programs.

Chapters 13 to 16 tie together everything you have learned. This is the dessert course. My assembly-language programming technique always started with coding after some sketchy mental problem definition. Dr. Leventhal has convinced me that this is wrong. Problem definition and program design should come first, followed by coding, debugging, testing, documentation, maintenance and redesign.

1. Introduction to assembly-language programming
2. Assemblers
3. 8080/8085 instruction sets
4. Simple programs
5. Simple program loops
6. Character-coded data
7. Code conversion
8. Arithmetic problems
9. Tables and lists
10. Subroutines
11. Input-output
12. Interrupts
13. Problem definition and program design
14. Debugging and testing
15. Documentation and redesign
16. Sample projects

Table 1.

8080A/8085 Assembly Language Programming has many more points to make... too many to cover here. This is not a one-evening book. If you have an 8080 or 8085 (improved 8080) CPU or have access to one, the ideal learning situation is to try the examples as you go along. Each chapter has, in addition, a series of problems for which clues, but no coded solutions, are supplied. These give you a chance to try your hand at assembly-language programming.

Particularly interesting is the discussion on various programming methods: flowcharting, modular, structured and top down. Although no one method is touted as being *the best*, each is explained, and advantages and disadvantages presented. Clearly, the author leans toward structured programming.

Major statements are printed in boldface type, and explanations to these statements are printed in a lighter type. The tendency is to read only the boldface sentences until you come to one that you don't understand, at which time you read the lightface type for clarification. Out of habit, I found myself reading it all.

This is definitely a software-oriented text, but an amazing amount of hardware information is given in the I/O and interrupt chapters—probably enough to implement any of the designs discussed.

So far, I have covered all the book's good points but none of its bad ones. That is probably because I couldn't find anything to criticize. My only negative reaction has to do with *8080A/8085 Assembly Language Programming* having been advertised as available in October 1977, which is when I ordered and paid for it; it was actually not printed until late January 1978, which is when I received it.

In my opinion, *8080A/8085 Assembly Language Programming* is a worthwhile text; and I'm hoping for a Z-80 version soon. If my technical library had to be reduced in size for some reason, this is certainly one book I would keep on the shelf!

Rod Hallen
Tombstone AZ

Simplified BASIC Programming
Gerald and Joan Silver
McGraw-Hill, New York
1974, \$12.85

Simplified BASIC Programming is an excellent text for those

of you who have absolutely no experience in computer programming and occasionally need to look up the definition or application of an instruction. *Simplified BASIC Programming* is an excellent reference manual.

The first section of the book is devoted to an in-depth explanation of the operation of a time-sharing system. For those of you who have access to a time-sharing system, this section is invaluable. For the microcomputer owner, this section may be skipped as your system probably operates in a substantially different manner.

The second section describes, in easy-to-understand language, how most of the instructions are used. I say *most* because in 1974 BASIC was not as sophisticated as it is today. Examples of the use of each instruction or combinations of instructions are clearly stated. At the end of each chapter, a review and a quiz are provided.

The last section of the book contains example programs with complete documentation and a description of the way the problem was solved.

This book is a good reference for those of us who can't seem to remember whether a comma or a semicolon is necessary to print closely spaced output, or any other syntax problem that may drive you to the brink of insanity.

Although *Simplified BASIC Programming* is available through any bookstore, you may find a used copy for sale at substantial savings at your friendly, neighborhood college bookstore. And if you are really watching your budget, you may find *Simplified BASIC Programming*, along with other informative reading on BASIC, at your local library.

Jim Cambron
Topeka KS

The 8080A Bugbook
Rony, Larsen, Titus
Howard W. Sams & Co., Inc.
Indianapolis IN
\$9.95, paperback

One book out of a hundred makes you wish you had seen that one before slogging through the other ninety-nine. This is such a book. It should be subtitled "All You Wanted To Know about the 8080 and Its Support Chips, but Didn't Know Where To Look."

In the Bugbook tradition, the 8080A neatly balances theory and practical example. It comprises eight chapters with titles such as,

"What is a Microcomputer?" and "An Introduction to Microcomputer Programming." They are all informative and readable.

Unfortunately, there are some errors (no doubt accidental, but possibly confusing to the reader). Occasionally, the authors give a detailed explanation that ends just when you expect some vital truth to be revealed; but these rare omissions serve mainly to demonstrate the thoroughness of the rest of the book.

Each chapter begins with an outline and ends with a summary and some searching questions. In light of its format, it could well be used as a textbook. Let's take chapter 4 to consider the book's style.

Title: Generating an output pulse.
Outline: Objectives, definitions, 8080 I/O instructions, device select, pulse decoding, sample microcomputer program, device select pulses as control pulses, example, test, and "What have you accomplished in this chapter?"

Introduction: "In this chapter you will learn how to generate device select pulses . . ."

At the end of the chapter the reader is asked to "draw a schematic diagram for a circuit that can generate up to 256 different device-select pulses."

And if you read the chapter you should be able to do the above, and a great deal more.

In following chapters the authors explain the use of these and other signals for the control of outside devices via timing loops and other programming sequences. Throughout, however, they stress keeping the hardware simple and exercising control by software.

I appreciated most of the simplified, no-mystique approach to several things that had long bothered me—among these were flag testing, the use of status words, and the inside working of the many conditional branch instructions. The entire instruction set is covered in greater detail than I had previously encountered. It is methodically considered by function—by grouping the related logical operations, for example—and whole pages are devoted to illustrating certain instructions that might be considered tricky or difficult.

The use of octal may disappoint some readers. The explanation is that the 8080 instruction set was designed this way. Logical operations all begin with 2 in octal, and MOV instructions with 1. The accumulator is 7 and the memory 6. Thus, MOV A,M and

MOV M,A are 176 and 167, respectively, much easier to remember than two dissimilar hex codes.

The book's overall theme is that the microprocessor is a useful tool. No mention is made of high-level languages, games or heavy number crunching; the interfacing is to practical devices and the programs are in simple machine language, all designed to "do something." And although the special 8080 support chips are all covered in some detail, TTL alternatives are explained where they can be applied.

It is difficult to classify this as either a hardware or a machine-language software book, since it is really both. If the reader could previously build a kit or follow a program, he should, after digesting this volume, be able to design much of his own hardware and write programs to interface with other devices. That's a lot to learn for only ten bucks.

Ernie Brooner
Lakeside MT

The Home Computer Revolution
Theodor H. Nelson
The Distributors,
702 So. Michigan South Bend
IN 46618, \$2

Most computer hobbyists, or those about to get into computing, will find this book easy to read, as well as entertaining. It is neither a technical book, nor a dry history book. The author has combined semitechnical material, computer-historical anecdotes and his forecast of the role of the computer in the future.

Reading this book, I found that my level of interest wavered between near boredom to moderate interest. However, because of the nature of the material, another reader might find different peaks and dips of interest.

For instance, as an advocate of the Altair bus, I reacted favorably to the author's repeated support of this configuration. A reader using the Digital Group bus, for example, might be disinterested in the Altair bus coverage.

At the other end of my interest spectrum, I found the frequent attacks on IBM to be objectionable. I have no particular like or dislike for IBM, but I certainly found the repeated negative attitude distracting.

It's a matter of psychology—if you like the Altair bus and have something against IBM, you'll enjoy the author's comments; on the other hand, if you don't like

the Altair bus structure and have a high regard for IBM, you won't enjoy reading this book.

A little more than half of *The Home Computer Revolution* is related to the author's predictions of the future home-computer world. Therefore, if you are going to read this book, do it now; very shortly, these precarious prognostications will either be history or wrong guesses. Some of the predictions concerning future home-computer input/output devices and techniques seem way out (but so was 1984 not very long ago).

On the positive side, I thought the historical notes on Mits, Cromemco and other companies were very interesting. Those readers new to home computing will find some seldom published background information.

There are brief hardware descriptions (Altair bus oriented), but with home computing moving so fast, a book would have to be published in loose-leaf style to keep up with the hardware changes. Only a monthly magazine, such as *Kilobaud*, can hope to keep you informed on the current hardware.

The program-languages descriptions are short, with most languages getting only one paragraph. The author suggests that a person learn programming with a BASIC interpreter, and this is probably what most home computerists are doing.

A serious oversight occurs on page 117. Add the following to the lists of available magazines on that page: *Kilobaud*, Peterborough NH 03458.

The Home Computer Revolution is light reading and generally entertaining; one of my next reading projects will be *Computer Lib* (\$7, same source), which is referred to often in this latest book by Theodor Nelson.

Gordon Flemming
Sylmar CA

**Home Computers: 2nd
Questions and Answers;**
Vol. 1: Hardware (\$7.95)
Vol. 2: Software (\$6.95)
Rich Didday dilithium Press
Forest Grove OR 1977

These two books fill a definite need. Most people who get started in the home-computer field find themselves in one of three situations: They know quite a bit about software but nothing about hardware; they know quite a bit about hardware but nothing about software; they don't know

much about either one.

The idea behind these books is that you can buy Vol. 1 if you're in the first category, Vol. 2 if you're in the second category, or both if you're in the third category.

That's the idea behind the books, but how well do they pull it off? Pretty darn well, I'd say.

Together, the two books represent a heavily edited transcript of nine days of conversation between two people on the subject of home or hobby computing. One of the participants (called "A" because he provides the answers) has a strong background in computing in general (both hardware and software), and home computing in particular.

The other participant (called "Q") is an intelligent, interested newcomer to the field who has visited the computer stores, picked up some literature and bought a few magazines, but needs further help to figure out what it all means. He doesn't understand too much of what he's read, and wants to know, for example, what is really involved in putting a computer kit together.

Is he better off getting a fully assembled system? Why are there so many different microprocessor chips? What does all this RAM/ROM/PROM/EPROM stuff mean? What's involved in programming? Why are there so many different programming languages? What can you really do with a home computer?

1024 is 2¹⁰, which is the number of questions and answers in the two books—thus the title for the work. But it's more than just a bunch of disjointed questions thrown together. The books are well organized and proceed logically from one topic to the next, building up your knowledge and tying things together as you read.

Of course, neither book is going to enable you to become a professional programmer or hardware designer overnight, but they'll give you a better idea of what these people do, and introduce you to some of the basics as they relate to home computing.

Usually, when I read an introductory level book or article on computing, I find myself saying, "That's not a very good example," or "Boy, that's sure going to mislead somebody." These books are a rare exception. The questions and answers both have a nice balance of simplicity, accuracy, and (amazingly enough) realism, and actually convey the

(continued on page 111)

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NEW PRODUCTS

Plotters—Kit and Assembled

Sylvanhill Laboratory, Inc., has been sold to Pitsco, Inc., and offers plotter kits and plotters completely assembled. The kits require the purchaser to mount them on a drawing surface (console also available as a new product of Sylvanhill) and to do the interconnection between the control PC boards and his computer. Plotters require an 8 bit parallel I/O port and 5 and 24 V power sources. A basic 8080 software program is included in the owner's manual.

Sizes available are 11 x 17 (\$795 in kit form), 17 x 22 (\$950 in kit form) and 22 x 34 (\$1300 in kit form). Consoles priced separately.

Contact the new offices and manufacturing facilities of Sylvanhill Laboratory, Inc., PO Box 646, Pittsburg KS 66762.

202 Video Camera Kit

Solid State Sales 202 Video Camera Kit may be used for visible or infrared viewing for character recognition with computers with external circuits. It will operate in a vacuum, under water, at high altitude or in a magnetic environment because there is no high voltage or magnetic deflection. In addition, it may be used for IR surveillance with an IR light source, and is excellent for standard surveillance work because of its light weight (under 1 lb.) and small size.

Some advantages offered in this new kit from previous models are all clock voltages operating at

6 V requiring no adjustments, and a higher video output signal. The circuitry has been simplified for easier assembly, and a two-level TTL output is supplied for interfacing. In addition, a power board is supplied so only a 5 V, 1 Amp power source is needed, and, in the near future, Solid State Sales will supply a computer interface card.

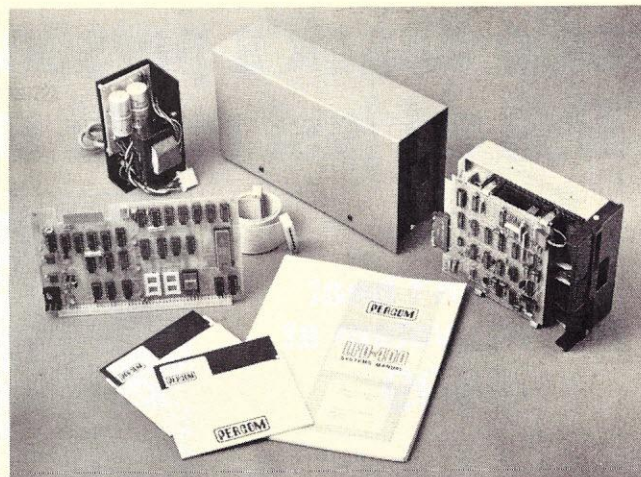
This kit includes all semiconductors, boards, data sheets, diagrams, resistors, capacitors, and an 8 mm lens. Assembly has been simplified so that the only equipment needed is an oscilloscope, soldering iron and some wire. The complete kit sells for \$349 (\$75 to assemble and test).

Solid State Sales, PO Box 74K, Somerville MA 02143.

Serial Interface Module

The 9650 is an asynchronous serial interface module specifically designed for compatibility with the M6800 microprocessor bus. It is pin and outline compatible with the Motorola EXORciser and Micromodules and with the MEK6800D2 Evaluation Kit. It features full address decoding and fully buffered data, address and control lines. This module utilizes 8 MC6850 Asynchronous Communications Interface Adapters with full RS-232C signal conditioning. An on-board bit rate generator simultaneously provides 14 standard rates that can be individually strapped to each ACIA.

The 9650 occupies 16 consecutive memory addresses. The lowest 8 of these access the 8 con-



PerCom's LFD-400 system.

trol/status registers and the next 8 access the transmit/receive data registers. This map arrangement allows optimum use of indexed addressing in I/O intensive systems and permits the use of a very tight interrupt polling loop.

The standard configuration of the 9650 is fully populated to 8 channels. Prices range from \$395 in single quantities to \$237 at 100. A partially populated 4-channel version is also available at lower prices.

The 9650 is one of a family of M6800 support modules. All cards of the family are 6.05 inches by 9.75 inches and utilize a 43-pin dual readout edge connector with 0.15625 inch pin spacing.

Creative Micro Systems, 6773 Westminster Avenue, Westminster CA 92683.

Disk Storage System for the SS-50 Bus

PerCom Data Co.'s LFD-400, a minifloppy[®] disk memory system for the SS-50 bus, includes a controller PC board, PROMware disk operating system, disk drive and drive power supply, interconnecting cable, two minidiskettes, an operator's manual and a compact enclosure to house

the drive and drive power supply. System components may be individually purchased, and 2- and 3-drive systems are also available.

The controller board, which is installed in an SS-50 bus slot of the host computer, includes special low-voltage-drop regulators, a proprietary "bit shifting" compensation circuit, an inactivity time-out circuit to increase drive motor life, and provision for 3K bytes of PROM. The LFD-400 PROMware DOS, miniDOS, allows SS-50 bus owners to use their existing software with simple patches. This was a priority consideration in the development of miniDOS.

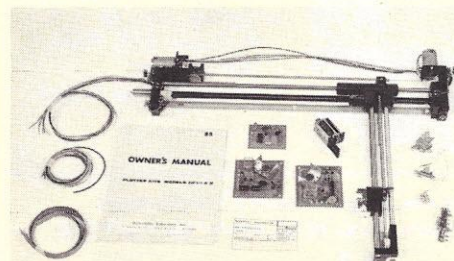
The LFD-400 uses the Shugart SA-400 drive. Disk speed is 300 rpm, which gives a data-transfer rate of 125 kilobits per second. The read/write head is stepped from track to track at 40 ms per step. The SA-400 drive system features a positive media interlock, which prevents door closure on a misaligned disk, and write protection circuitry. The LFD-400 storage media is a 10-sector hard-sectored minidiskette, which accommodates 89.6K bytes of data on 35 tracks. The recording technique is Bi-Phase-M (also known as "double frequency").

PerCom Data Company, Inc., 318 Barnes, Garland TX 75042.

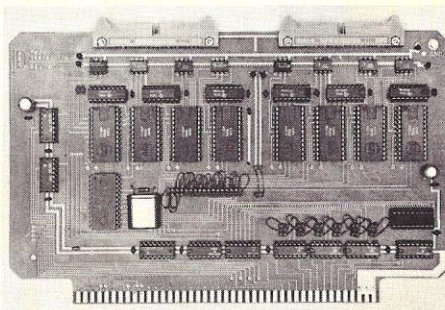
CT Terminals

COMPUTER TEXTile announces its line of high-quality hard-copy hardware. CT sells reconditioned QUME and Diablo daisy wheel printing terminals, which feature 30-cps printers, 96-character keyboards with 10-key numeric pad, ASCII coded, RS-232 interface.

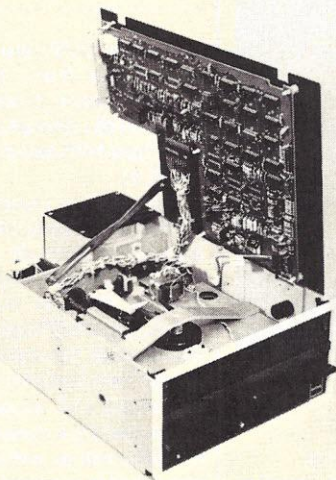
Also included are 256-charac-



Some of Sylvanhill's wares.



The CMS 9650.



The Innotronics Series 400 floppy disk drive.

ter buffer, user's and service manual, with full graphics capability packaged in a cabinet with black-and-chrome-wheeled pedestal. Options include 45-cps and 55-cps mechanisms for some QUMEs, other encodings, pin-feed platen, tractor forms feeder and service contracts.

Each terminal comes with a limited 30-day warranty. Quantities are limited. Prices from under \$2000. Also available are reconditioned ADM-1s, modems and paper tape punch/readers.

COMPUTER TEXTile, 10960 Wilshire Blvd., Suite 1504, Los Angeles CA 90024.

Innotronics Floppy Disk Drives

The new Series 400 diskette drive, offering an array of new features that were previously unavailable in the market, has recently been introduced by Innotronics. Unique new features include automatic head-unload and stepper motor time-outs, bidirectional write-protect, radial stepping ability for truly overlapping seeks, host power-failure detector and six different LED activity indicator electronics.

Both the Model 410 (soft-sectored, IBM-compatible) and the Model 420 (hard-sectored) provide single- and double-density recording capability. In addition, a proprietary data separator design, coupled with a digital noise filter and a unique way of handling recorded signals, results in 35 percent greater data integrity margins.

The Series 400 also incorporates the field-tested Innovex mechanical design, which includes filtered air operating environment, single-side accessibil-

ity for maintenance, mechanical door interlock with a manual override button, targeted media loading, and a patented "wear-free" diskette hub rated for over 100,000 insertions. Prices for the Innovex Series 400 range from \$575 in single quantities to \$435 each for orders of 100.

Innotronics Corporation, Brooks Rd., Lincoln MA 01773.

Printer Interface for Apple II

Microproducts has announced a printer interface for the Apple II computer which is compatible with the Southwest Technical Products PR-40 Printer. It will be marketed as a preassembled PC board that plugs directly into the Apple II computer, an interconnecting cable and a cassette containing the operating software.

The printer prints one line at a time when the return key is struck. The printer subroutine can also be called in BASIC to print the entire contents of the video screen. While in the BASIC mode, using the list subroutine, the printer will continually record the program, while the video screen scrolls up one line at a



CSD's Microdesk.

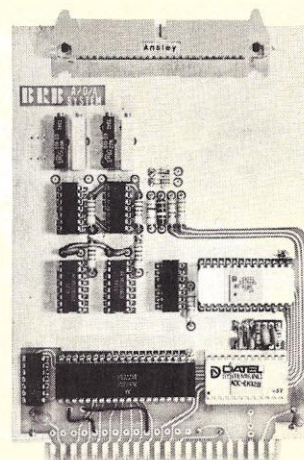
time. The complete plug-in interface with software sells for \$49.95.

Microproducts, Dept. K, 1024 17th Street, Hermosa Beach CA 90265.

Microcomputer Storage System

The Computer Systems Design Microdesk is a new addition to Kilobaud's microcomputer lab. (We ran a release on the Microdesk in November 1977; now we've had a chance to utilize it.) The desk's ease of assembly makes for a quick and useful addition to any room, with one adjustable shelf that you can arrange to your specific needs. Because of its air-vented design, the upper shelf is an excellent location for your unit. You can keep the unit close at hand without its being in the way. There's plenty of room for your terminal, and a sliding keyboard shelf can put the keyboard within comfortable reach—or out of the way when you're not using it.

The lower shelf fully handles the task of holding all the manuals that accompany a small microcomputer lab. The Micro-



Wintek's analog interface module.

desk is sturdily designed to last a long time under normal conditions.

Computer Systems Design, 1611 E. Central, Wichita KS 67214.

Microprocessor Analog Interface Module

The Wince Analog Interface Module makes it easy for laboratory and control engineers to interface thermocouples and other transducers to a microprocessor. It makes it equally easy to interface the microprocessor to motors, servos, etc. Options include a 16 channel multiplexer, an 8, 10, or 12 bit analog-to-digital converter, and one or two 8 bit digital-to-analog converters. The base price is \$99. Other Wince Modules include the Control, RAM, ROM, EROM Programmer, CMOS RAM/Battery, Driver/Sensor, Console I/O, Cassette Interface.

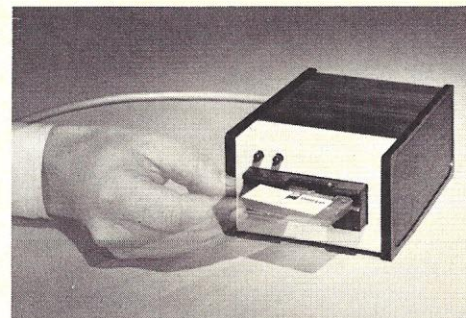
Wintek Corp., 902 N. 9th St. Lafayette IN 47904.

The Stringy Floppy

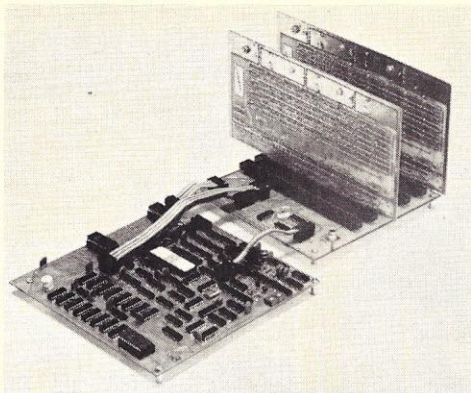
The Exatron Stringy Floppy™ is a subsystem consisting of a con-



Microproducts interface with Apple and PR-40.



Exatron's Stringy Floppy.



Central Data 2650 Computer System.

trol board connecting to the S-100 bus, a small drive module outside the computer mainframe and the connecting cable.

The individual continuous-loop tape wafer, less than a fourth the bulk of the standard audio cassette and holding up to 40K bytes, is inserted in the slot in the front of the drive module, and will save or load 4K bytes in about 5 seconds. All operations are software controlled; the utility programs are contained in an EPROM on the control board. The subsystem is delivered ready to operate, and is backed by a one-year full warranty and a 30-day money-back guarantee.

Exatron Corp., 1030 East Duane, Suite 1, Sunnyvale CA 94086.

The Electric Pencil II

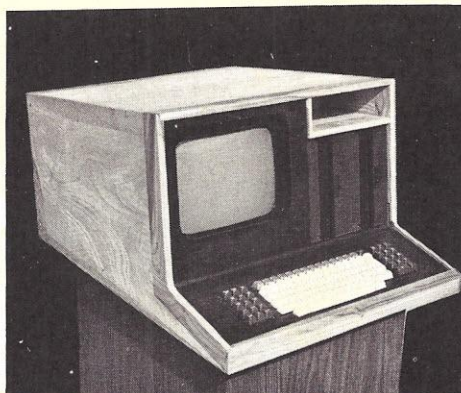
Michael Shrayr Software, 3901 Los Feliz Blvd., Los Angeles CA 90027, announces the Electric Pencil II. Some of the new features include: CP/M compatibility, simple file management, dynamic print formatting, multi-column printing, cassette backup capability, centering, underlining and boldface.

The Electric Pencil II is now available on CP/M—standard printer versions \$225; Diablo printer versions \$275. System hardware must include: 8080 or Z-80 based microcomputer, printer, video display, CP/M supported disk system, or North Star minifloppy disk, or cassette interface (Tarbell or SOL).

The Electric Pencil I is still available for non-CP/M users. Contact Michael Shrayr for more information.

Central Data Boards

Central Data, PO Box 2484,



Northwest's 85/P.

Sta. A, Champaign IL 61820, offers a 16K RAM board specially designed for use in S-100 computers. The dynamic memory board uses a reliable refresh method that inserts cycles between the computer's normal access cycles. The 16K RAM board uses less than one-half the power of a comparable static RAM board.

CD's board comes completely assembled, tested and burned in—just plug it in and start using. Each board also comes with a full one-year warranty. Price is \$289. There is capacity on the board for up to 32K RAM (\$475), or add 16K for \$200.

S-100 extender board, assembled and tested, is \$110. The 2650 Computer System board retails for \$275. System board features include: 80 x 16 line display, 2650 microprocessor, 300 baud cassette interface, supervisor program, two parallel ports, one input and one output, and 2048 bytes of read-write memory.

Naked Terminal Cuts Dumb Terminal Costs 1/3

Dynabyte, Inc., lowers the cost of a dumb terminal with its Naked Terminal, an S-100 module that functions with a key-

board and video monitor.

The Naked Terminal, priced at \$395, displays 80 characters by 24 lines, using both uppercase and lowercase characters in a 5 x 7 font. Half duplex, full duplex and a block mode that allows editing before transmission are features of the Naked Terminal. Editing is aided by an addressable cursor.

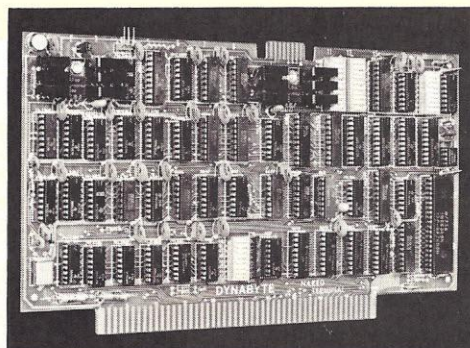
Switch-selectable features include black-on-white or white-on-black, blinking or nonblinking — cursor, and variable baud rates.

No software is required. The Naked Terminal can be configured by DIP switch to drop into an existing system, replacing the serial I/O card and stand-alone terminal without making any changes to software.

The Naked Terminal is a complete dumb terminal on an S-100 board. It contains a microprocessor with its own memory, its own software drivers and its own internal bus. It won't take up any of the 64K memory address space of the S-100 bus.

Like all Dynabyte products, the Naked Terminal is completely assembled, socketed, tested and burned in. Dynabyte's guarantee is for a full year—the longest in the industry.

Dynabyte, Inc., 4020 Fabian, Palo Alto CA 94303.



Dynabyte's Naked Terminal.

8085 + PASCAL = 85/P

The new 85/P, programmer's workbench from Northwest Microcomputer Systems, Inc., combines the throughput of the 3 MHz Intel 8085 and the power of PASCAL.

The standard system features: (1) 8085 CPU with 54K bytes of static user RAM; (2) one megabyte of storage in two double-density Shugart floppy-disk drives; (3) 24 x 80 high-resolution display with 103 station Hall effect keyboard; (4) two serial ports for printer and second terminal or modem; (5) a choice of attractive solid oak or walnut cabinets that enhance any home or office.

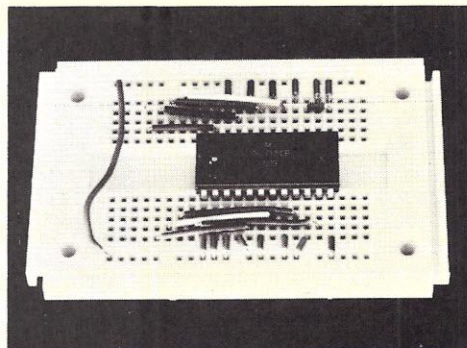
The 85/P gains its efficiency in program preparation and code execution from the increasingly popular PASCAL language. The 85/P provides the full PASCAL environment including a 700 lpm compiler/interpreter, random and sequential files, a screen-oriented editor, interactive, source-linked debugger, plus full documentation and a 90-day warranty.

The complete system costs \$7495. Delivery is quoted at 30 to 60 days, with Northwest Microcomputer Systems paying for delivery on any order shipped later than 60 days. A variety of options is available.

Northwest Microcomputer Systems, Inc., 121 E 11th, Eugene OR 97401.

"Byte-Size Breadboards" from CSC

The age of LSI has put a lot of power in Lilliput for users of Continental Specialties Corporation Experimentor Socket solderless breadboards. This seems especially true for the palm-size EXP350 and EXP650. Each is just 3.6 inches long. The EXP350 offers .3 inch center spacing to



The EXP650.

accept standard DIP packages; the EXP650 offers the wide .6 inch spacing appropriate to wide LSI DIPs. Their small size offers the perfect opportunity for byte-size modularity. This can happen in several ways.

A complex LSI function IC like a UART, for example, can be accommodated, along with pertinent support discretes and connecting cables as a module on a CSC EXP650. An LSI function can be synthesized with less complex circuitry. A counter, decoder and display, for example, can be combined on a single EXP350 and treated as a unit—as can a data converter, an interface circuit or any of a number of functional modules.

CSC's EXP350 is priced at \$5.50 (unit), the EXP650 at \$6.25.

Continental Specialties Corporation, 70 Fulton Terrace, New Haven CT 06509.

REX Computing System

RCC introduces REX—the total microcomputer system, fully assembled, complete with a Z-80 CPU, 24K of RAM, video output, system keyboard, a microfloppy disk drive featuring double-sided recording, cabinet and power supply.

The REX system includes an S-100 motherboard containing the CPU, video display interface, bootstrap and Monitor PROM, and powerfail and vectored interrupt circuitry. The system comes complete with a modern walnut-sided cabinet and a 15 Amp power supply, and includes space for a second microfloppy drive plus five slots for S-100 bus options.

A complete line of low-cost software options is available. These include ANSI FORTRAN IV with subroutine library and 8080 and Z-80 extensions, including advanced math and string-handling functions; floppy-disk operating system; file manage-



GRI Model 756 keyboard.

ment system; text editor; and linking loader.

RCC offers a wide range of options for the REX system, including b & w or color video monitors, rf modulator generator, expansion microfloppy drives, RAM memory to 64K on the motherboard (no bus slots needed), a 120 cps 80/96 column printer programmable serial communications channel, and a data communications modem. The REX system lists for \$2495, assembled and tested only.

Realistic Controls Corp., 404 W. 35th Street, Davenport IA 52806.

New Model 756 Full ASCII Keyboard

The Model 756 keyboard from George Risk Industries provides encoding for all 128 ASCII characters and control functions, imposing no limitations on software design or hardware capability. Utilizing reliable IBM series keyswitches and low-power MOS encoder circuitry, Model 756 is designed to bridge the gap between basic keyboards and expensive custom OEM models. Assembly and mounting are simplified through OEM industrial grade components and a rugged MIL-grade printed-circuit board. The durable circuitry is complemented by custom molded keytops and a line of heavy-gauge steel enclosures for desktop use.

The 756's complete line of ac-

cessories includes a numeric pad, custom cables and connectors. The versatile interface allows user selection of parity, positive or negative logic data and strobe outputs, alpha lock operation and both dc level and pulse strobe signals. A latching shift lock key is included, and all outputs are TTL-DTL-MOS compatible. Kit is \$64.95; assembled and tested model, \$75.95. A matching enclosure, Model 702, is \$29.95.

George Risk Industries, Inc., GRI Plaza, Kimball NE 69145.

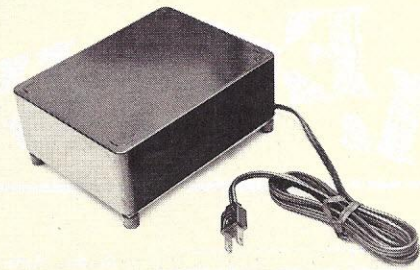
Computer-related Cases

The Buckeye Stamping Company, 555 Marion Rd., Columbus OH 43207, now offers instrument cases with keyboard holders and CRT canopies. These computer-related additions, fabricated of durable, extruded aluminum, are offered in standard 17 inch widths. The new cases are now offered with blue or black vinyl tops with matching feature stripes, or with teakwood vinyl as an option.

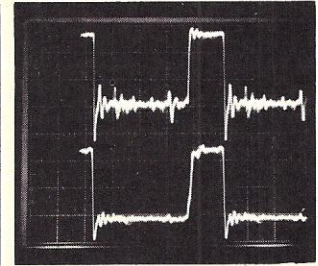
The new Buckeye computer-related cases sell in small quantities in a price range of \$110 or \$215, complete.

Power Supply for KIM

K L Power Supplies, PO Box 86, Montgomeryville PA 18936, announces the model 512 power



K L Model 512 Power Supply.



Bottom oscilloscope signals show noise reduction made possible by the Glitch Grabber.

supply for MOS Technology KIM users, and for others needing a 5 volt and 12 volt regulated supply. The model 512 comes completely assembled and includes a total 4.3 Amp capacity and additional 8K memory.

The K L power supply features +5 volts regulated with 1.4 Amp maximum, +12 volts regulated with 1.0 Amp maximum, +8 volts unregulated with 4.5 Amp maximum, and +16 volts unregulated with 1.0 Amp maximum. It has regulated outputs with current limit and thermal overload protection, fuse-protected primary, ac line cord, and connector cable.

The unit is enclosed in a Bakelite case with aluminum bottom plate and rubber feet. It is 6.8 x 5.6 x 3 inches and weighs 3.5 lbs. Price is \$37.

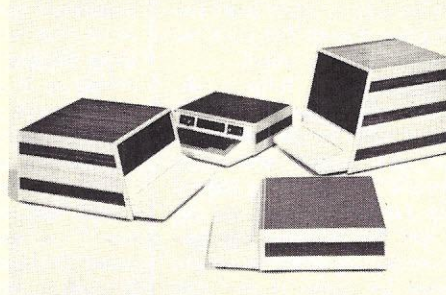
New "Glitch Grabber" from Extensys

A board interconnection device from Extensys Corp. significantly reduces noise, glitches and jitter on the S-100 microcomputer bus and carries a suggested retail price of \$79.50 in single quantities (large-volume discounts available). Called the "Glitch Grabber," the printed circuit edge-connective device maintains clean signals on the notoriously noisy S-100 bus, safeguarding the low tolerance volt-

(continued on page 111)



RCC's REX Microcomputer.



Buckeye instrument cases.

LETTERS

PC Board-makers, Take Note!

Your otherwise fine article on making printed circuit boards (*Kilobaud*, April 1978) fails to give instructions and precautions for handling the chemical used to develop the photoresist-coated boards. The resist developer recommended is of completely different nature than the chemicals normally encountered by the home photography enthusiast.

I'm sure that your readers are aware that the resist developer is flammable and will take precautions to exclude potential ignition sources. They may not be aware that methylene chloride is the active ingredient in paint remover. As such it will rapidly ruin any painted or varnished surface with which it makes contact. A more serious consequence of splashes is that the developer is a serious skin and eye irritant.

Methylene chloride is an extremely volatile liquid. This means that a room containing an open tray of the developer solution would rapidly have its air contaminated with substantial amounts of the vapor. In a small bathroom with the windows and doors closed to make a temporary darkroom, the vapor concentration could far exceed the recommended peak exposure level. The present federal peak limit is 2000 ppm, but the National Institute for Occupational Safety and Health has recommended that it be substantially reduced.

Methylene chloride, which enters the body by inhalation, is rapidly metabolized. One of its breakdown products is carbon monoxide. This reacts with the hemoglobin in blood and reduces its oxygen carrying capacity. The heart and circulatory system must then work extra hard to pump blood faster in an attempt to make up for the decreased oxygen supply. Methylene chloride also affects the central nervous system as an anesthetic.

I recommend that anyone using a developer containing methylene chloride follow the general recommendations for paint removers in *Consumer Reports* (August 1976, page 434):

● "If at all possible, work out-

doors. And try to stay upwind . . . If you must work indoors, make sure there's plenty of ventilation—not just from an open window or two, but from a strong window exhaust fan.

● "Wear neoprene rubber gloves and goggles. If you splash yourself, wash the affected area immediately with soap and water.

● "Keep children away from the work site, and store the container out of their reach."

The developing of the photoresist could easily be performed safely in the backyard after sunset. The photoresist is not so light sensitive that night background illumination would be a problem.

None of the chemicals used in this process should be stored in a refrigerator that contains food, and flammable chemicals should never be stored in any home refrigerator.

With these precautions and common sense, printed circuit boards can safely and successfully be made at home.

Jim Warner
Board of Studies in Chemistry
University of California
Santa Cruz CA 95064

The Wired OR . . . Again!

I read with interest R. W. Burhans' letter (p. 21) regarding the wired OR in the December 1977 *Kilobaud* and would like to inject some word of warning. The wired OR (or, more correctly, wired NOR), when used with TTL devices, should be used *only*, I repeat, *only* with open-collector types. The M²L logic (I love Don Lancaster's term) or diode logic should be used *only*, I repeat, *only* with CMOS devices (which have logic levels much more forgiving than that of TTL) or if the input consists of a switch.

Anybody who follows Mr. Burhans' advice and uses diode isolated AND or OR configurations with normal (totem-pole output) TTL gates of the 7400 or 74LS family is asking for *big* trouble. The reason is simple: The worst-case low-level output voltage for gates of the 7400 family is .4 volts; for 74LS family it is .5 volts. Fast silicon diodes

(like those of the 1N444X family) at a forward current of .1 mA have a static forward voltage of maximal .55 volts (these figures come from the TI manuals).

If now the output of a TTL gate is driving the input of a following gate via a decoupling diode, the low-level input voltage for this gate can be .5 plus .55 or 1.05 volts or even higher, depending on the size of the pull-up resistor. The maximum permissible low-level voltage for all devices of the 7400 and 74LS series, however, is only .8 volts. That means this arrangement operates in a voltage range that is outside of the manufacturer's specifications. The circuit *may* work sometimes, and then it may not work, depending on the whim of the ICs, power buses, temperature and phase of the moon.

That's the reason diode logic with TTL devices having a normal (totem-pole) output should *not*, I repeat, *not* be used (unless, maybe, you are using hot carrier diodes, which have a lower forward voltage but are very expensive, or germanium—remember germanium—diodes, which are slow).

Erich A. Pfeiffer
Granada Hills CA

Ralph Burhans' Reply

The critique of "The Wired OR . . . Again!" is perfectly correct in stating that use of diodes in series with normal totem-pole TTL output (not O.C.) could create problems in excessive zero voltage drop and is not recommended by chip manufacturers. However, experimenters often do what is possible and not what is recommended, particularly if the risk of failure is very small.

Before the widespread use of MSI and LSI, many of us used Don Lancaster's technique (*TTL Cookbook*, Fig. 3-18A, p. 146) where a 74154 decoder is used to address a diode ROM matrix with a lot of NOR intersections. These work quite well, and I don't recall any failures. With the 74LS138 mentioned previously, a two diode NOR with one pull-up resistor provides elegant simplicity driving a D input on a KIM 74LS145 with no problems in my limited experience with four or five different chips.

It is also correct to state that CMOS has essentially no problem . . . so where is the argument? The basic difference in our thinking is perhaps that adverbs like "no" or "only" are applied here with some judgement based

on a typical case (not necessarily the worst case) and experimental trial. I built my first crystal set in 1933 and also know about germanium and use 1N695s if nothing else will work for a "quick and dirty" NOR. Many computer mods, where only a single extra input is needed, can be quickly solved with a single diode, and some of ours have been working for years with no problems.

When designing from scratch, I presently prefer CMOS, but when modifying someone's design, any trick of the trade is valid in my view. Diodes often solve a problem simpler than any other approach. Diode ANDs are still another method where input switching matrices for memory use can be implemented such as in Don Lancaster's *TTL Cookbook* (Fig. 6-27, p. 256).

Ralph W. Burhans
Athens OH

Due Credit

Just received *Kilobaud* No. 16 yesterday; the article was in there. What a good feeling, until I spotted the title block. Oh my!

new 4K EPROM board from
SWTP

Credit needs to be given where credit is due.

new 4K EPROM board from
APTEC

The goof was not in the proof copy I received because no title block was included.

Harley D. Johnson
Oregon City OR

8080 Simulator Notes

I want to commend your magazine and Lee Stork for a functional and useful program/article on the 8080 Simulator (*Kilobaud*, September 1977, p. 64). After debugging I was able to adapt this program to an Intel 8/Mod 80, to which I have access. For the benefit of readers who have tried, or are going to try, this program, here are a few notes:

1. At address 134, the mnemonic LSI should be LXI.

2. At address 172, MVI B, 5 was necessary to send a line feed to my console output device (a CRT terminal).

3. Likewise, address 138 needed MVI B, 2 to give me the proper display format.

4. At address 1FD, my ICOM FDOS II assembler creates a

OUTPT:	IN	1	;GET STATUS BYTE
	ANI	4	;MASK BYTE
	JNZ	OUTPT	;LOOP IF NOT READY
	MOV	A,M	;READY FOR DATA
	ANI	7FH	;ZERO PARITY BIT
	CMA		;INVERT BYTE
	OUT	0	;SEND IT TO PORT 0
	DCR	B	;DCRM. LOOP CNTR
	RZ		;RETURN IF DONE
	INX	H	;GET NEXT CHAR. IF
			;NOT DONE
	JMP	OUTPT	
INP:	IN	1	;GET STATUS
	ANI	01	;MASK
	JNZ	INP	
	IN	0	
	CMA		
	ANI	7FH	
	RET		

Table 1.

machine code of 41,00, rather than the necessary 41,20. This can be rectified if a space follows the A in the source of DW 'A'. It should read DW 'A '.

5. My assembler didn't like the instructions given it on addresses 210-212, it would rather have seen SPACE: DB 20H,20H,20H.

6. Similarly, address 213 assembles to 0A0D, rather than the necessary 0D0A. A source statement fix of DW 0A0DH will straighten that out.

7. As is necessary for most machines, I had to rewrite the I/O routines to conform with the Intel TTY interface card. For those of you who have an Intellec 8/Mod 80, the routines are shown in Table 1.

This program is an asset to any hobbyist or programmer who programs in 8080 assembly language.

Rick Beutnagel
Hilton NY

Score 2— For Consumer Computer

In the March 1978 issue of *Kilobaud*, a short article entitled "Consumer Computer, Inc.," appeared. This work describes software, written in North Star BASIC, capable of generating replies to billing form letters produced by large computers employed by giant corporations. The article stated that this software is running on an Imsai 8080 and is being utilized to do battle with one of the largest credit-card companies in business.

Well, the results are in, and Consumer Computer, Inc., lost a few battles but won the war. The form letters generated by the microprocessor were completely ignored by American Express and its overgrown computer system.

This was anticipated, since anything short of enclosing your payment within a ton of cement is usually insufficient to allow any correspondence to escape from the batch-processing syndrome. Therefore, Consumer Computer, Inc., was overcome in its first skirmish. No billing problem was corrected and a fee for the services of Consumer Computer was certainly not collected from the firm issuing the improper billings.

Round two saw "yours truly" taking American Express to New York City's Small Claims Court. Running true to form, American Express failed to answer the summons to appear in court. This caused a judgment to be entered against American Express. The arbitrator, who calculated the amount of the judgment award, allowed an added \$70 for expenses (largely Consumer Computer, Inc.). Thus, Consumer Computer, Inc., won an overwhelming victory by correcting my billing difficulties and collecting \$70 from "Goliath," rather than the \$25 fee it was originally hoping to charge American Express for its services.

Beware Master Charge, Visa, Carte Blanche, et al—Consumer Computer is ready to pounce wherever and whenever you make the slightest error by slipping a loose bit in your overgrown computer frame.

Joseph Roehrig
Middle Village NY

"Tiger Trouble" Trouble

This letter refers to the article "Tiger Trouble" (p. 106) in the March 1978 issue. Although the calculator used was not identified, I have assumed that it is either an SR-52, TI-58 or TI-59.

The program as printed on p.

108 contains errors in syntax, especially on line 72, which calls for a function not directly executable on these machines within the number of steps allotted, and on line 63, where no error halt at a "flashing 9.999 999999 99" will occur, at least on the TI-58/59, unless an R/S is provided or flag 8 is set. Furthermore, even after all syntax is corrected for the TI-59, this program will not yield the expected result with a seed of 0.9 given on pp. 108-109.

I suggest that in future articles on TI calculator programs, you specify the calculator model for which the program is intended, and that you provide a copy of the PC-100A program-listing printout, so that no ambiguity in interpretation is possible.

David P. Leising
Grand Rapids MI

It is an SR-56 program, and I apologize for the omission.
—John.

Defective Formula

In the December 1977 *Kilobaud*, p. 24, one of your correspondents suggests the formula $\text{arc sin } X = \text{ATN}(X/\text{SQR}(1-X^2))$. This formula has the defect that when $X = 1$ or -1 , a division by zero is required. Also, when X is close to 1 or -1 , accuracy is impaired through the loss of significant digits in forming $1-X^2$.

I suggest instead the formula $\text{arc sin } X = 2 * \text{ATN}(X/(1 + \text{SQR}(1-X^2)))$. This formula is theoretically exact and preserves the number of significant digits. Also, X^2 usually executes faster and more accurately than X^2 .

The formula $\text{arc cos } X = -\text{arc sin } X + (0.5 * \pi)$ holds in all cases, giving the angle between 0 and π radians.

Charles A. McCarthy
St. Paul MN

Meatless Article

The quality of articles in *Kilobaud* has always ranged from fantastic to restating the obvious, and I have no complaints about this. However, in the April issue, on pages 116, 117, I found the biggest waste of paper I have ever seen in your magazine. Jim Huffman's "Finally: 8080 Meets the Fairchild Video Game" was a farce. It was nothing more than two pages of: . . . 9023, a number not yet given in any data books . . . will release data in a

month or so . . . doing something . . . should be a piece of cake . . . you could add . . . and you would be able to have . . . the schematic . . . was not available . . . at some time in the future will be invaluable. Etc. I am keenly interested in this subject and just wanted to express my disappointment.

H. J. Kuhman
Pittsburgh PA

Once in a while I really blow it, and this was one of those occasions. It was simply my enthusiasm for the subject, and that of many readers, that made me decide to run the article. Thanks for the feedback; I'll try to be more careful.—John.

A Stimulating Response

Thank you for sending our book, *Stimulating Simulations*, to a reviewer who took the time to read the text and actually put the program listings into the computer. Robert Soltysik's statements (*Kilobaud*, April 1978, p. 13), although not in complete agreement with mine, were obviously based on careful examination of the book. His objectivity was certainly a relief after I read a review of *The Devil's Dungeon* in the March issue of *Interface Age*. The *Interface Age* reviewer made statements that indicated he had not entered the program in the computer or even read the scenario carefully. Instead, he vented his hatred for computer games, The Wumpus in particular, on my poor little book, which many readers and publishers have found delightful. Thank you for employing intelligent and conscientious reviewers. The next time I want to communicate with the West Coast, it will be through your magazine.

There was one problem with the review, however. My address and the price of the book were omitted. *Stimulating Simulations* sells for \$5 and can be purchased from Engel Enterprises, PO Box 16612-K, Tampa FL 33687.

Jane E. Engel
Publisher

6800 Owners: Look Out!

I recently purchased *Practical Microcomputer Programming: The M6800* by W. J. Weller, Northern Technology Books, 1977, \$21.95. I am very disappointed with the book and hope you will not promote it. Here are

my complaints:

1. There are no equipment block diagrams, such as to describe programming models of the MPU, PIA or ACIA. This is a particular disadvantage when trying to describe the behavior of the peripheral chips.

2. There is no description of the hardware interrupt signals, even though there is a chapter on interrupts. Also, this chapter contains inaccurate or misleading statements.

3. The book departs from Motorola assembly language with several pseudo-ops, with some of the number base conventions and with indexed address notation.

4. The book uses no flowcharts to outline or generalize programs.

5. The chapter on floating-point arithmetic could have been written for any computer or microprocessor. It had no real how-to-do-it information and did not even mention any actual floating formats.

I feel that the book is not well organized, but this, I know, is a subjective matter.

Who am I? MSEE with ten years' experience on minis and interfacing. Owner of Altair 680 and MEK6800D2 kit. Instructor (moonlight job) on 6800 system at Midwest College of Engineering. 31 years as W9CUP.

I do like Barden's book (reviewed in January 1978 *Kilobaud*) and the *Scelbi 6800 Software Gourmet Guide and Cookbook*.

Terry A. Jackson
Lombard IL

More Articles on the 1802?

This is a brief letter of concern directed to your magazine. So far, most of the articles published deal directly with the 6800 series computers or the 8000 series computers. I agree these are popular, however, you seem to overlook the RCA CDP 1802 MPU.

Certainly a large audience exists for this computer, outcropping from the COSMAC Elf series, Netronics Elf II, COSMAC Micro tutor, UC 1800 and the COSMAC VIP. An outlay of only \$100 is needed for a basic computer.

Please publish more articles for the CDP 1802 COSMAC series.

Mike Otis
Aberdeen SD

I've said it before, Mike, but you've given me the opportunity to say it again . . . and I thank you. I don't have a magic hat to

reach into and pull out articles on a particular computer. We publish articles that have been written. If you, or any other 1802 owner, would like to see more material on the 1802, then go directly to your typewriter . . . do not pass GO . . . but perhaps you will collect that \$200! You're right about the 1802 gaining in popularity and I'll be happy to see more written about it. —John.

Computer-Portraits Franchise

I read with interest your letter and reply in the letters column of December 1977 on the subject of computer portraits. We are presently setting up a franchise organization that will allow just about anyone to go into computer portraits. The franchise fee will be, not \$7000 to \$10,000, but only \$5000 for everything, including the computer, line printer, TV camera, video monitor and software. We feel this system will have more capabilities than any other system available, and we are dedicated to continually upgrading all units in the field so it will remain so. Anyone desiring more information is invited to write me at Tri Mark Engineering, 12402 W. Kingsgate, Knoxville TN 37922.

Marshall Dudley
President

Sounds like a good topic for an article, Marshall. —John.

Demystifying the April Tic-Tac-Toe Program

I'm sorry about the errors in the Tic-Tac-Toe article appearing in the April *Kilobaud*. Basically what happened is:

1. I wrote the article before I had a printer and attempted to type the listings from my video.

2. *Kilobaud* returned a draft of the article. This draft contained numerous errors in the listing (my fault) and pages of program listing were out of order (*Kilobaud* placed page 10 in front of 9).

3. The new proof was sent to me and we still had problems. John Craig and I decided to hold publication of the article until I obtained a computer-generated listing.

4. I sent computer listings writ-

ten in North Star BASIC, since I no longer had Altair equipment. This changed the article drastically.

5. We decided to go with corrected versions of the typed listing so as not to change the article.

6. In the confusion, the necessary corrections were not incorporated and one additional type-setting error was added.

I have no Altair BASIC, so I cannot supply a listing. The corrections are shown in Fig. 1.

Other answers to questions are shown in Fig. 2.

In addition to the corrections, I have attached a North Star listing of a similar game (see below).

Thanks for your understanding.

Joseph J. Roehrig
Middle Village NY

```
30 FORA=1TO3:A1=A*10:FORA2=1TO10:FORA3=0TO3
105 IFA>64OR1>ATHENPRINT'ILLEGAL MOVE':GOTO90
200 M3=-9
280 IF5>A6THENM2=M2+A6:A6=GOTO300
320 IFM2>M3THENM3=M2:M4=A
392 A1=INT((M4-1)/16)+1:A2=M4-((A1-1)*16)
1000 PRINT'POSITIONS ARE':FORA=0TO3:FORA1=1TO13STEP4:A2=20+(A1*4)
```

Fig. 1.

NEXTA1,A Altair BASIC lets you end multi for loops with
NEXT by listing the variable of the loops to be ended
\$(A) Altair BASIC treats string variables similar to
numeric values. Thus :
Altair \$(1) could mean 'UU' and \$(2) would be 'CC'
North Star \$(1,2)='UU' and \$(3,4)='CC'

Fig. 2.

```
10 DIMS(64),W(3,76),S$(64),V(76)
11 DIMC(64,8)
20 FORA=1TO10:FORA1=0TO3:READW(A1,A)\NEXTA1\NEXTA
30 FORA=1TO3:A1=A*10:FORA2=1TO10:FORA3=0TO3
40 W(A3,A1+A2)=W(A3,A2)+(16*A)\NEXTA3\NEXTA2\NEXTA
42 !"HOW SHALL I PLAY ? 1=BEST 2=GOOD"
44 INPUT " " 3=FAIR 4=POOR ? ",Q9
46 IFQ9<1THENQ9=1:IFQ9>4THENQ9=4
50 FORA=41TO56:FORA1=0TO3
60 W(A1,A)=(A1*16)+A-40:NEXTA1\NEXTA
70 FORA=57TO76:FORA1=0TO3:READW(A1,A)\NEXTA1\NEXTA
72 DATA1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,1,5,9,13,2,6,10,14
74 DATA3,7,11,15,4,8,12,16,1,6,11,16,4,7,10,13,1,22,43,64
76 DATA5,22,39,56,9,26,43,60,13,26,39,52,2,22,42,62,14,26,38,50
78 DATA3,23,43,63,15,27,39,51,4,23,42,61,8,23,38,53,12,27,42,57,16,27,38,49
80 FORA=1TO64:S$=S$+" "S(A)=0:NEXTA
83 DATA 1,21,41,61,1,18,35,52,4,19,34,49,4,24,44,64
84 DATA13,25,37,49,13,30,47,64,16,31,46,61,16,28,40,52
85 PRINT'YOUR MOVES ARE UU AND I'M CC'
86 FORA=1TO76:FORA1=0TO3:A2=W(A1,A)\A3=-1
87 A3=A3+1:IFC9(A2,A3)=0THEN89
88 GOTO87
89 C9(A2,A3)=A\NEXTA1\NEXTA
90 GOSUB1000:INPUT'YOUR BOARD, POSITION ? ',A1,A2
100 A=((A1-1)*16)+A2
105 IFA>64THEN118
107 IF1>ATHEN118
109 IFS(A)<>0THEN118:GOTO120
118 PRINT'ILLEGAL MOVE':GOTO90
120 S(A)=1:S$(A,A)='U'
125 U2=A:U4=1:GOSUB1400
190 M5=0:FORA=1TO76
196 IFV(A)=4THEN410
198 IFV(A)=15THENM5=A
199 NEXTA:IFM5<>0THEN365
200 M3=-9
204 Y1=0
205 FORA=1TO64
```

(continued on page 110)

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Taming the I/O Selectric (Part 1)

It's time to get that I/O Selectric you've been using as a typewriter and interface it to your home computer.



Photo 1. The IBM Model 731 Selectric as used in the 1014 Remote Inquiry Unit. The case has an extension on the bottom to house the solenoids, which permit remote operation of the typewriter.

IBM is no longer making the I/O Selectric and as more and more IBM systems are upgraded there will be an increasing number of these units coming onto the surplus market. I've seen several articles on interfacing the Selectric, but I believe this is one of the best. It's very likely the I/O Selectric will become more and more popular as a hard copy device for hobby systems due to its rugged construction (no comparison with an office Selectric) and the cost (\$700 to \$950). The Model 731, which Emerson's article is based on, is mechanically the same as the Model 735. — John.

Last spring I was just getting started in the home computer hobby. I had assembled my SWTPC M-6800 kit and was making my first attempt at programming when it became obvious that any serious work would require a hard copy output. As is the case with all computer hobbyists, I talked about it at

work, and a friend offered me a surplus IBM 1014 Remote Inquiry Terminal, which contained an IBM Selectric Model 731 typewriter. So, here was my hard copy output device; all that I had to do was interface it with my computer.

Well, it's all working now, and I am very happy with it.

It makes beautiful copy. Now I can type assembly listings, use my computer as a text editor and type out letters or articles like this one.

Last January I gave a talk about my Selectric Interface at a meeting of the Computer Hobbyist Group of North Texas, which was received with a lot of interest. Editor John Craig heard about it and suggested an article for *Kilobaud*. So, I am now sitting at my TVT typing words into RAM and printing them out on the Selectric.

The Selectric Interface is presented in two parts: Part one describes the hardware, and part two will cover the software.

More Than a Printer

The 1014 Remote Inquiry Terminal is of early 1960 vintage. The Selectric is mounted on a heavy steel desk, which is full of power supply, relays and diodes. I didn't have room for the desk so I removed the Selectric and discarded the relay encoder and decoder circuitry. That meant that I had to provide everything between the 6800 output and the solenoids in the Selectric. I also decided to give my hard copy printer some extra smarts by arranging for computer control of typewriter on/off, single or double spacing, all capitals or upper and lower-

case letters, and automatic page formatting. This was to be done by means of non-printing control characters, as will be explained in part two.

The Mechanical Marvel

The Selectric typewriter is a mechanical marvel or nightmare, depending on whether it is working right or you are trying to understand how it works and repair and adjust it. The basic typewriter is entirely mechanical except for the electric motor and switch. The characters are selected by tilting and rotating the ball (typing element) to get the proper character in position, and then striking the ribbon and paper with it. The sequence of events goes something like this: The motor drives a pulley through a toothed belt, which drives the operational shaft on the right side of the machine. A series of clutches and cams on this shaft performs the carrier return, line feed, tab, space, back space and shift functions (more about this later). The pulley also drives the cycle shaft on the left through a clutch on the pulley. The cycle shaft drives the filter shaft and print shaft through gears and does the print function.

When you press a key, an interposer is pushed down so that it trips the cycle clutch to start the print mechanism. It is also positioned so that a blade on the filter shaft strikes it and pushes it forward. The interposers, a different one for each key, have teeth that push against six selector bails. The selector bails in turn push latches from under a latch bail that is being pushed down by cams on the cycle shaft. If the latches are left hooked, the latch bail will operate a mechanical differential mechanism that moves pulleys to pull on the steel tapes. These tapes are wrapped around two drums which rotate and tilt the type element. If the six latches are hooked, they produce rota-

tion of one unit (R1), two units (R2) and two units (R2A) to the right, and tilt of one (T1) and two (T2) units. The five-unit rotation (R5) is an exception. Latching prevents five units of rotation to the left. Combinations of these latches can then print any of the 44 characters on half of the type element (four rows with 11 characters per row). The shift operation turns the ball 180 degrees so that the characters on the other half of the ball can be printed.

Though all this may sound like a Rube Goldberg machine, it is really a carefully designed device, with interlocks to prevent improper operation if the operator presses two keys at once, or if there are other timing problems. Long trouble-free service is obtained through wear-adjusting compensation. You have to take your hat off to the Selectric designers.

You don't have to understand all this to get the point — to control the Selectric by the computer, all you have to do is provide solenoids to control the latches. Similar solenoids can control the clutches for space, back space, carrier return, line feed, tab and shift. My Selectric had all of the solenoids except for the shift. If yours doesn't, and you have a little mechanical ability, you should be able to add solenoids made from old relays. Before you start, be sure to get a copy of the service manual for your typewriter. Manuals and repair parts can be obtained through your local IBM office or through an IBM Parts Distribution Center, which, in major centers like Dallas, provide 24-hour service at fair prices.

How Many Control Lines?

There are 13 Selectric functions, so it would seem

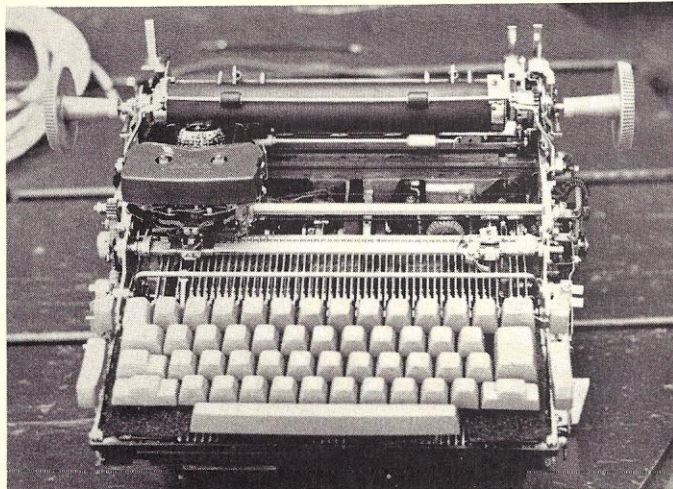


Photo 2. The type element is visible on the carrier. The carrier rides on the print shaft, which is driven by gears on the left side. The 11-inch platen has pins for paper drive.

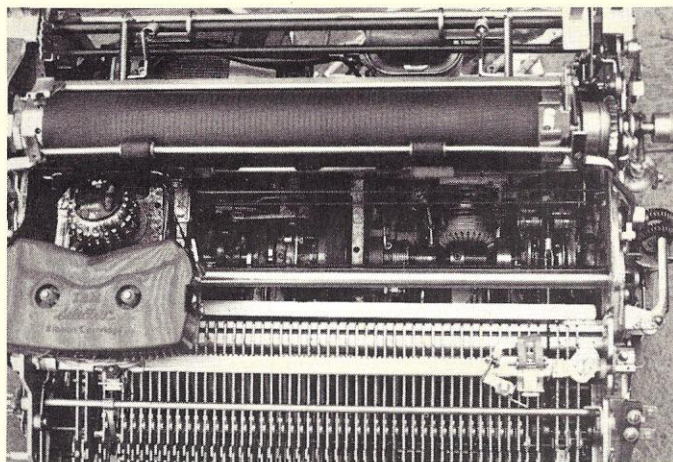


Photo 3. The belt drive is in the center of the photo. To the left of the drive pulley are the cycle clutch, five-unit cam, selector cam and reset cam on the cycle shaft. To the right is the operation shaft with the shock release clutch, carrier return clutch and pinion, tab governor and pinion, space and back space clutch and cam, and carrier return and index clutch and cam. The shift mechanism is on the right end of the operation shaft.

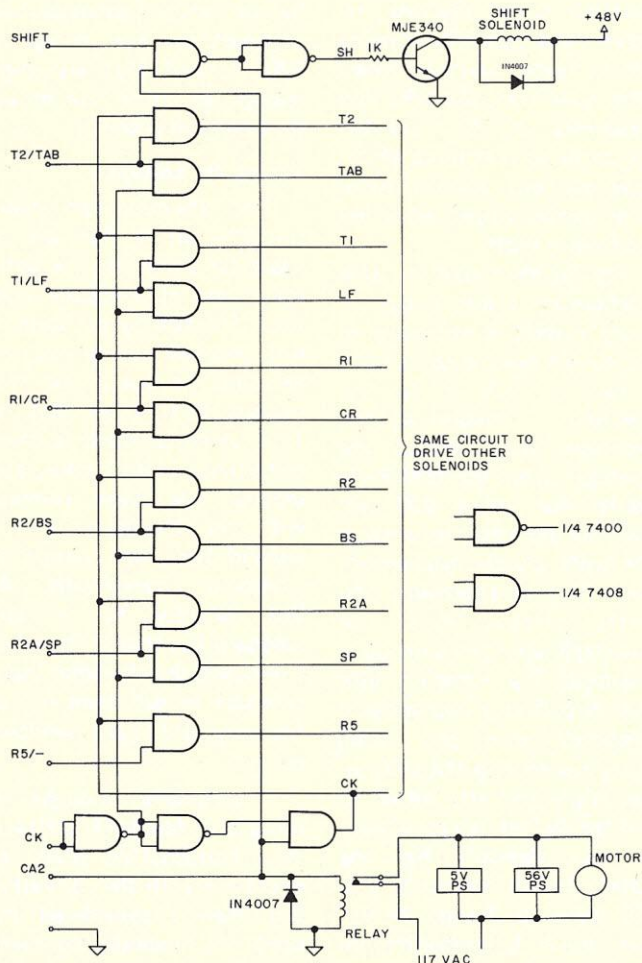


Fig. 1. Interface circuit diagram.

that 13 control circuits from the computer would be required to control the typewriter. However, when the typewriter is typing a character only the seven type element control functions, R1, R2, R2A, R5, T1, T2 and CK (trip the cycle clutch), and SH (shift) may be required at the same time. The next five functions, SP (space), BS (back space), CR (carrier return), IND (index = IBM for line feed) and TAB (tabulate), do not need any of the type element control functions. This allows a line-saving multiplexing scheme to be used. As shown in the

circuit diagram (Fig. 1), the CK line that is always on when a character is being typed is used to control the electronic equivalent of a six-pole double-throw switch. When CK is on, the type element control functions are connected to the computer. When CK is off, the non-printing functions are connected.

The shift function must not change during a character typing operation and is provided a control line of its own so that it may be controlled separately from the other functions.

With this interface cir-

cuitry, all of the functions of the typewriter can be controlled. For example, to do a line feed, binary 00100000 or hex 20 should be the output to the typewriter. To type a capital A requires shift up, tilt two units and rotate left two units. The typewriter then requires binary 10100111 or hex A7. If the typewriter was in a down-shift condition, a binary 10000000 or hex 80 would be required to shift up before sending the typewriter the A7 to type A. As soon as the typewriter has started the type operation, the output should be changed to 80 to hold the up-shift condition but allow resetting of the latches to prevent typing a string of AAAAAAAA. Now, if a hyphen is to be typed, shift down, tilt three and five right rotation are required. Before typing, 00 would be sent to the typewriter to

cause down shift. Then binary 00000001 or hex 01 would cause "-" to be typed. Following this pattern, you can make up a table of typewriter codes for all of the characters on the type element just by noting what shift, tilt and rotation is needed.

Turning on the typewriter and the power supplies is a little different because the switching circuit can't work with the power supply off. To get around this I used the CA2 handshake control line to directly operate a relay (Radio Shack #275-004). The power relay applies the 115 V ac to the typewriter motor, the 5 V and 56 V power supplies.

The solenoids in the typewriter require about 48 V dc at about 100 mA to operate reliably. This is too much for the usual TTL device, so a driver circuit is required. I

used surplus Motorola MJE340 Darlington transistors, one for each solenoid. All of the solenoids in the typewriter were disconnected from the original circuit, and reconnected with common leads to the +56 V supply. The transistor collector was connected to the other terminal of the appropriate solenoid, with a 1N4007 diode to protect the transistor from the solenoid fly-back voltage. (A similar fly-back protection diode is provided with the power relay.) The transistors are driven directly from the TTL ICs with a series 1k Ohm resistor to limit current. The power supply is 56 V to allow for voltage drop in the transistors and supply 48 V to the solenoids.

The solenoids in the typewriter operate trip-type mechanisms — that is, when a solenoid is energized it trips a latch, and then even if the solenoid is turned off, the function is still enabled. To prevent the typewriter's being left in some unknown character condition, the CA2 line interlocks the CK and SH functions so that none of the type element control functions can be tripped while the typewriter is off.

My Selectric had no shift mechanism when I got it. Since a shift is necessary to get all the desired characters, I had to add it to the machine. I bought all the necessary parts except the solenoids from the IBM Parts Center for about \$20 and used an old relay to operate the shift clutch mechanism. With this arrangement, the shift circuit must be energized whenever shift-up is required. The standard IBM shift circuit uses two latching solenoids with one being energized to trip the shift-up condition and the other to trip the shift-down condition. If your Selectric has the standard shift solenoids you will want to change the circuit shown by providing another transistor to operate the second shift solenoid and

two one-shots with about 20 milliseconds on time to drive the two shift solenoids. The shift line switching on should then trigger the up-shift one-shot and when the shift line switches off the down-shift one-shot should be triggered.

The 5 V power supply is a 1 Amp regulated supply I got in a kit. The 56 V supply was made from a surplus 40 V 1 Amp transformer, bridge 1 Amp rectifiers, a surplus 1000 uF 100 V filter capacitor, but no regulator.

The interface circuitry was built on Vector .1 inch perforated circuit board and with a Vector wiring pencil and solder-through wire. All of the circuitry and power supplies were mounted on a plastic cradle in the space under the typewriter mechanism, as shown in the photo. The third transformer was required because my typewriter motor turned out to be a 208 V motor. I found a 75 V 1 Amp surplus transformer, which I connected up to boost the line voltage to 190 V, and that was high enough to make the motor start and run properly.

Timing By Software

The Selectric had many contacts on it for use as character input to the computer and as feedback contacts for timing purposes. I had decided not to use the Selectric keyboard for two reasons. First, I felt that the TVT terminal made a more convenient input device, and second, the type element with the characters that I wanted bore no relation to keyboard arrangement. My 731 Selectric has a non-standard keyboard. Therefore I removed the character input contacts to get them out of the way and make servicing easier.

I originally thought of using the feedback contacts in a handshaking mode of operation with the computer. But then I considered the need to maintain contacts, the added interface circuitry required and the possibility

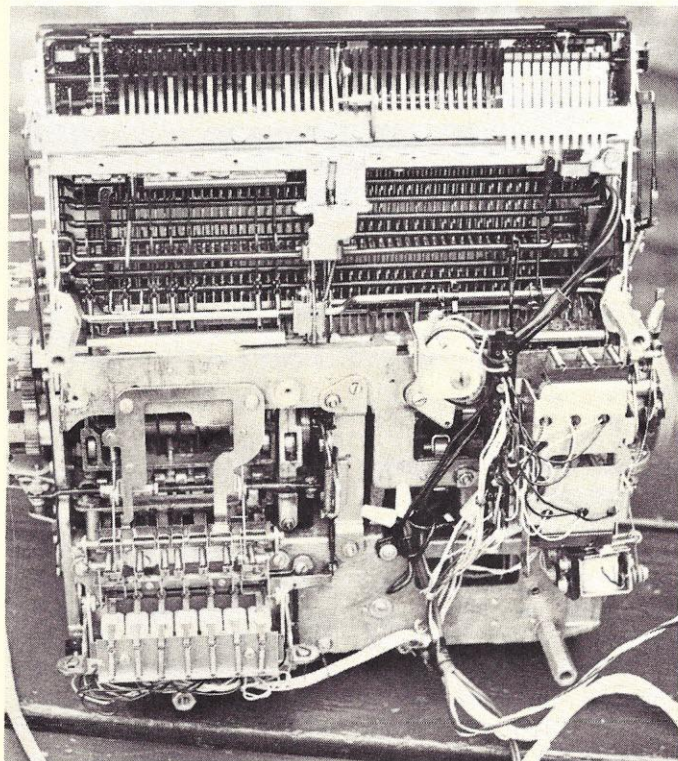


Photo 4. A view of the underside shows the seven selector solenoids at the left rear. These push the latches from under the latch bail for character selection. The vertical bars at the front under the keyboard are the interposers, and the horizontal bars are the selector bails mentioned in the text. On the right side are the five operation solenoids for space, carrier return, etc. Below these is the relay I added to trip the shift mechanism. The solenoid near the middle is a keyboard lock-out which I have not used. The typewriter mechanism sits in a plastic cradle, which serves as a mounting for the parts for the electrical interface.

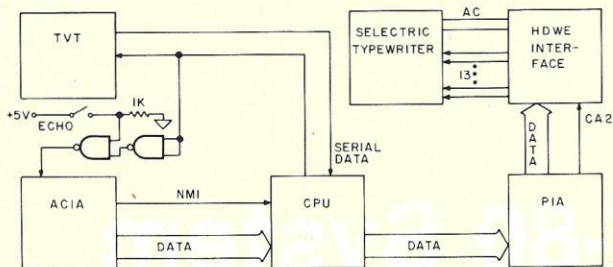


Fig. 2. System block diagram.

of the computer's hanging up waiting for a missing contact closure because of grease, dirt or other problems. Open loop software timing by the computer looked pretty good, and as it has turned out it was a trouble-free choice.

In order to do the software timing, you have to know accurately the time required for each function, or allow extra time for the uncertainty and thus slow down the output rate.

The basic timing comes from the rotation of the operational shaft, which turns at $7\frac{1}{2}$ revolutions per second. When the cycle clutch is engaged to type a character it turns at the same speed as the operational shaft. The cycle shaft cams are double lobed, and so type a character in half a revolution. This means that the basic maximum typing speed is 15 characters per second (or 67 milliseconds per character), which is pretty respectable. The pull-in time for the solenoids is appreciable, about ten milliseconds. However, all of the typewriter functions are initiated by solenoids; so this common time doesn't have to be counted, as far as the software timing is concerned, because the pull-in time can overlap the completion of another function.

Shift up or shift down must be done as a separate function, and not while typing a character. A half revolution of the operational shaft is required for either shift up or shift down ($1/15$ second or 67 milliseconds).

Space and back space are also done in half a revolution of the operational shaft, but

with a difference. The cycle and shift clutches are wrap-up spring clutches, and take hold almost instantly. The space, back space, carrier return and line feed clutches are sprocket-and-dog clutches, the sprocket having nine teeth. This means that there is a $1/9$ operational shaft revolution time uncertainty or 15 milliseconds in the time for these functions. For this reason, the space and back space functions are allowed 81 milliseconds.

Line feed requires a full turn of the operational shaft and gives a time of 148 milliseconds when the clutch uncertainty is added. The time required for carrier return is dependent upon how far the carrier has to travel. I allowed 525 milliseconds for the carrier return — enough for an 80-character line.

Where Do You Plug It In?

There are ten wires going to the typewriter — eight for typing functions, one for the power relay and a common ground. These connect to an MC6820 peripheral interface adapter (PIA) in the computer: the eight control lines to the data output PIA terminals and the power relay line to the CA2 terminal. Then the computer only has to put the proper outputs to the PIA to control the typewriter.

I thought the easiest way to interface the typewriter to the program requiring hard copy output would be to have the typewriter echo what is being written on the TVT screen, thus requiring minimum modification of existing programs. The sys-

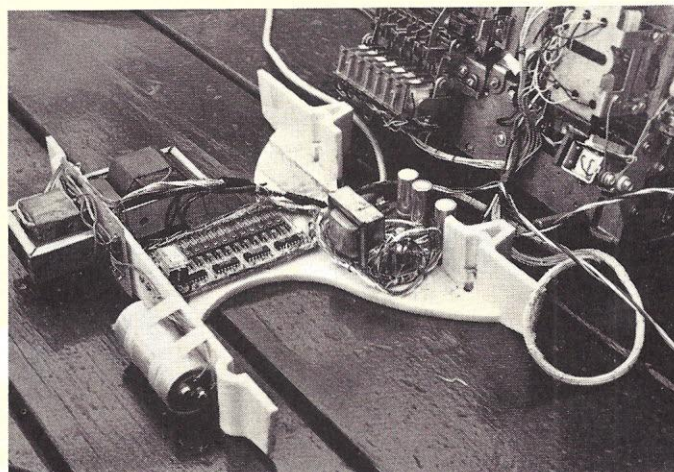


Photo 5. On the left is the 56 V power supply to operate the solenoids. The other large transformer is to adapt the 208 V motor to the 117 V power. The circuit board with the transistors, diodes, and the ICs that control the solenoids are mounted on the bottom of the cradle beneath the power relay. The 5 V power supply is at the rear.

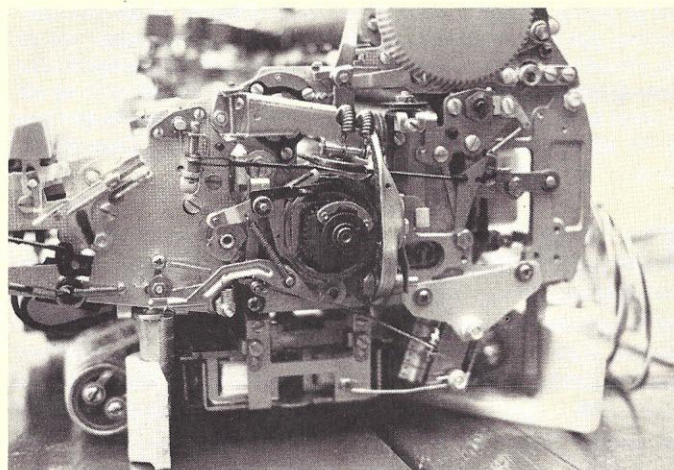


Photo 6. The shift clutch, cam, and solenoid had to be added to my machine. The shift cam pushes out the arm with the pulley on the upper end, which pulls the rotate tape to turn the type element 180 degrees.

tem block diagram (Fig. 2) shows how this was done.

Two NAND gates (7400) were connected in cascade, with the ECHO switch tied to one of the inputs of the second gate. The two inputs of the first gate connect to the serial data line from the computer to the TVT. When the ECHO switch is on, the output of the second gate echos the serial data going to the TVT. When that switch is off, the output is high or mark. The output is connected to the serial input terminal of an MC6850 asynchronous communications interface adapter (ACIA). With the echo switch on,

when a character has been sent to the TVT and the ACIA has received it, the ACIA interrupts the computer through the nonmaskable interrupt line (NMI). The computer takes the character from the ACIA receive buffer, converts it to the proper control byte for the typewriter and puts the byte out to the PIA. After the proper time delay for typewriter operation, the computer is returned to the main program.

The software that does all of this and controls the Selectric typewriter will be described in part two of this article. ■

Home-Brew Z-80 System (Part 1)

If you want to build your own system from scratch, just follow these instructions.

Due to the informal nature of Kilobaud, we don't normally provide an author's profile with each article... or even discuss an author's background. With Norm Thagard, I'm going to make an exception. Norm was one of 8079 applicants for America's next generation of astronauts... the NASA Mission Specialists who will be going into orbit aboard the Space Shuttle. When the competition got narrowed down to 208 aspirants Norm called me on the phone and told me he wanted to use the fact that he had built a home-brew computer system, and published an article on it, as additional leverage with NASA. Maybe it helped, because he was one of the 35 selected for the mission-specialist slots. Congratulations... and the very best to you, Norm.—John.

The availability of several low-cost S-100-compatible Z-80 CPU boards, the high cost (for a medical student) of commercial S-100 systems and a burning desire to have a personal Z-80 system prompted me to design and construct a front panel that provides the logic to use the commercial CPU boards in an otherwise home-brew system. In my case, the S.D. Sales Z-80 CPU card was available locally and was the starting point for the design.

Lacking software experience with the Z-80, I needed a software-independent unit. Indeed, one of my major goals was to have a system with which I could develop software. The result was a manual front panel permitting direct access to memory for both read and write operations.

Armed with the Z-80 technical manual and the schematic of the S.D. Sales CPU card, I began the design. The outgrowth of the effort is depicted in this article.

Design Considerations

There were several things I

especially wanted from my system: First, compatibility with the many commercial S-100 peripherals available. Since I was using the commercial CPU card, this aim was easily met—I only had to avoid compromising what was already there. Second, an expandable system—up to 64K of memory and I/O ports galore. Basically, this meant the use of Tri-state buffers in an expandable bus configuration.

Also, I wanted to use, wherever possible, standard TTL chips that I had pulled off old boards at an average cost of three or four cents. I wanted to avoid, at all costs, the use of special devices. However, in the interest of reducing bus loading and parts counts, I was willing to use some low-power Schottky packages.

I was also willing to sacrifice the dynamic refresh capability of the Z-80 to take advantage of a straightforward method of front-panel operation. This method is called direct memory access (DMA) and is readily implemented with the Z-80 MPU. Dynamic memory could still be

used but would require the use of an external refresh circuit.

My home-brew TVT is entirely stand-alone with off-line capability; so I did not care that DMA by other devices, such as DMA requiring TVTs, would not be possible during front-panel operation. This would not be a serious disadvantage considering the normal reason for using the front panel, that is, for small program development and/or bootstrapping tape programs into memory. With data latches and additional logic, it would be possible to restore full DMA operation. Single-step operation is a nice feature permitting you to go through a program op code by op code. This is very handy for debugging software and, fortunately, very easily implemented.

Theory of Operation

DMA is possible with a Tri-state bus system and some means to suspend MPU operation. On the Z-80 chip is a pin labeled BUSRQ. It might better be named DMARQ because bringing this pin low forces the MPU to set its address, data and Tri-state output control signals to the third, or high-impedance state, thereby facilitating DMA operation. In our case, switch S3 (Fig. 1) is debounced and forces $\overline{\text{PHOLD}}$ low, which is applied through a Tri-state buffer at the CPU card to pin 25 of the Z-80 MPU (Fig. 2). As soon as the current machine cycle is ended, the MPU grants the request and acknowledges the grant by

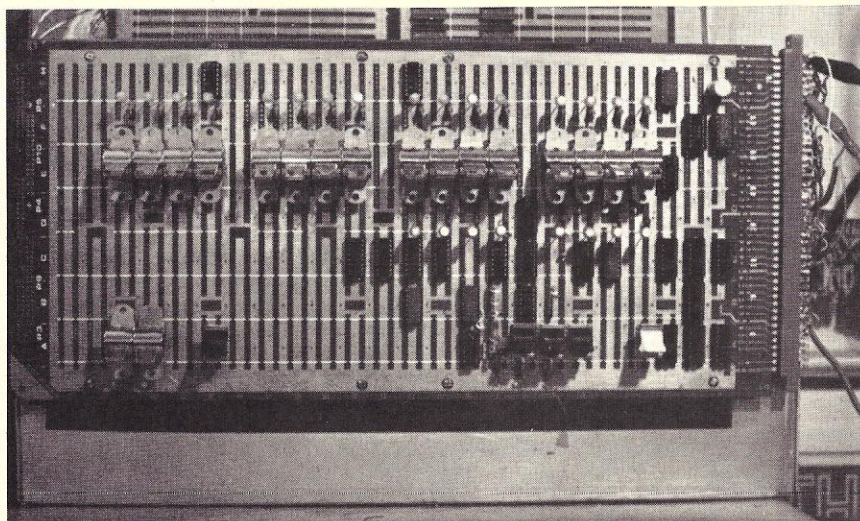
bringing $\overline{\text{BUSAK}}$ low. On the CPU card, this signal is inverted to become the S-100 signal PHLDA (DMAG or DMA grant).

If the front panel has requested the DMA, the address bus is controlled by 74193 counters through Tri-state buffers ICs 15 to 17. At the same time, control of the data-out bus is made possible should a front-panel write operation ensue. Finally, the CPU card Tri-state buffers are disabled by the active low signals $\overline{\text{CC DSBL}}$, $\overline{\text{DO DSBL}}$, $\overline{\text{SDSBL}}$ and $\overline{\text{ADDRDSB}}$.

ICs 19 to 21 are depicted as 74LS368 Tri-state buffers, but could be 8T98 or 8098 types as direct replacements. However, the 8T98 will draw more current and the 8098 will represent a larger load to the bus. Alternatively, 7404, 7405 or 7406 types could be used with a different pin-out and higher bus loading. The 74LS04 cannot be used because it will sink only eight mA in output low state. A bit that is at logic one will cause the indicator LEDs to be forward biased and the 10 or 12 mA should give adequate light output.

To load the address, set the 16 sense switches, SS0 to SS15, to the desired location and toggle the LOAD ADDRESS switch S7. This brings the load pin on the four counters, IC11 to 14, low, which latches the address. Then this address appears at the Q outputs and at the address bus via the buffers.

To increment an address already loaded, toggle the EX-



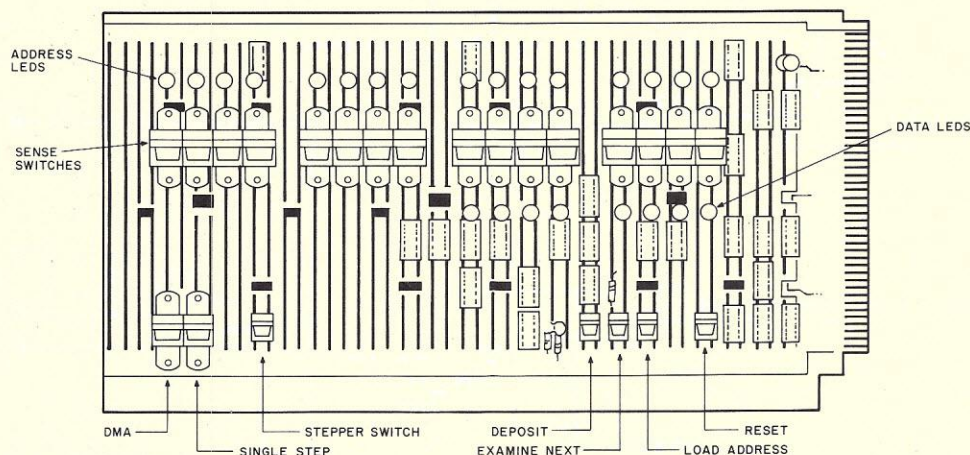
its socket. Bend pin 11 outward carefully and replace the IC (be careful that pin 11 remains outside the socket). If other Z-80 circuit boards output the machine cycle state $\overline{M1}$ on bus line D05 (S-100 bus line 39) during PSYNC, it may be necessary to disable this feature in a similar manner. Otherwise, attempts to load memory from the front panel may result in errors in bit 5 as two Tri-state devices fight each other for control of that bit.

Construction

Because of a fortuitous circumstance (low price and availability), my front panel was constructed on a large prototyping board with excellent ground and power buses. Either this sort of board or an S-100 prototyping board is recommended. If the S-100 board is used, you can simply take a standard aluminum chassis of appropriate size, mount the desired number of S-100 edge connectors on top of the chassis, hand-wire the connectors together and place the front-panel board in the forwardmost edge connector. (The pin connections on the diagrams reflect S-100 bus signals.)

A PC board is really not very practical. It would be tedious to design and would not be suited for the inevitable modifications that home-brew enthusiasts are prone to make. Wire-wrap and wiring pencil are the two techniques usually employed; I used the latter. Layout is by no means critical, and I actually used no bypass capacitors except for 50 μ F electrolytics at the points where V_{cc} entered the board. However, good practice (according to Don Lancaster's *TTL Cookbook*) calls for one 0.01 to 0.1 μ F ceramic capacitor per four gate packages or per two MSI packages. When using a wiring pencil, it is a good idea to check continuity of each interconnection with an ohmmeter.

You may generally follow the layout shown in the accompanying photograph or change it to suit your own inclinations.



Results of my efforts.

AMINE NEXT switch S5, which is debounced and applied through IC7a to pin 5 of IC11. Note that the increment does not occur until S5 is released. This is because the 74193 counts up on a zero-to-one transition, which does not occur until S5 is released.

Access to the data-out bus is through buffers IC17 and 18. These buffers are activated only during a write operation. After the desired address is loaded, the data is set by sense switches SS0 to SS7, which do double duty as data and low-order address byte switches. With the data set, the DEPOSIT switch S4 is activated. If DMA has been granted to the front panel, the debounced toggle passes through IC7b to IC9a, a one-shot. The one-shot places the data on the data-out bus by enabling IC17 and 18 and triggers the write pulse generator IC9b. At the end of the data-

enable pulse from IC9a, the address counters are incremented automatically to access the next sequential location.

The data-in bus is continuously monitored by the inverter/LED circuitry of IC6 and 22. Here, 7404 types are used because there is little need to reduce loading on a bus that usually communicates only with the CPU.

If a program has been loaded into memory, it will execute, starting at location 0000₁₆, by returning the DMA switch to RUN and then depressing the RESET switch S6. If the CONTINUOUS/SINGLE STEP switch S1 is in CONTINUOUS mode, the execution will continue until a software HALT, 76₁₆, is encountered or DMA is requested and granted. If SINGLE STEP mode is selected, each op code must be executed one at a time by toggling the STEPPER

switch S2. This switch is debounced and clocks in a logic one to the D flip-flop IC2a. This, in turn, allows \overline{PRDY} to go high via IC4c and 10. \overline{PRDY} communicates with \overline{WAIT} on the Z-80 MPU. As long as \overline{WAIT} is held low, the Z-80 will continue to "spin its wheels" by executing wait states.

Activating the STEPPER switch allows the Z-80 to resume normal operation until the next instruction-fetch cycle comes up. When this happens, the Z-80 signals the event by bringing its $\overline{M1}$ pin low. This signal appears inverted as SM1 on the S-100 bus and will trigger the one-shot IC1. In turn, IC1 clears the flip-flop once again, bringing \overline{PRDY} low and throwing the Z-80 back into neutral until the next STEPPER switch toggle.

One change should be made on the S.D. Sales CPU card. IC20 should be removed from

A word of advice: the DEPOSIT, EXAMINE NEXT and STEPPER switches will be frequently used and should be conveniently placed. The sense switches can be grouped in fours as shown for hex notation or in

threes for octal. Although space requirements may tempt you to place the sense switches as close together as possible without grouping them, don't do it! With such an arrangement your error rate will

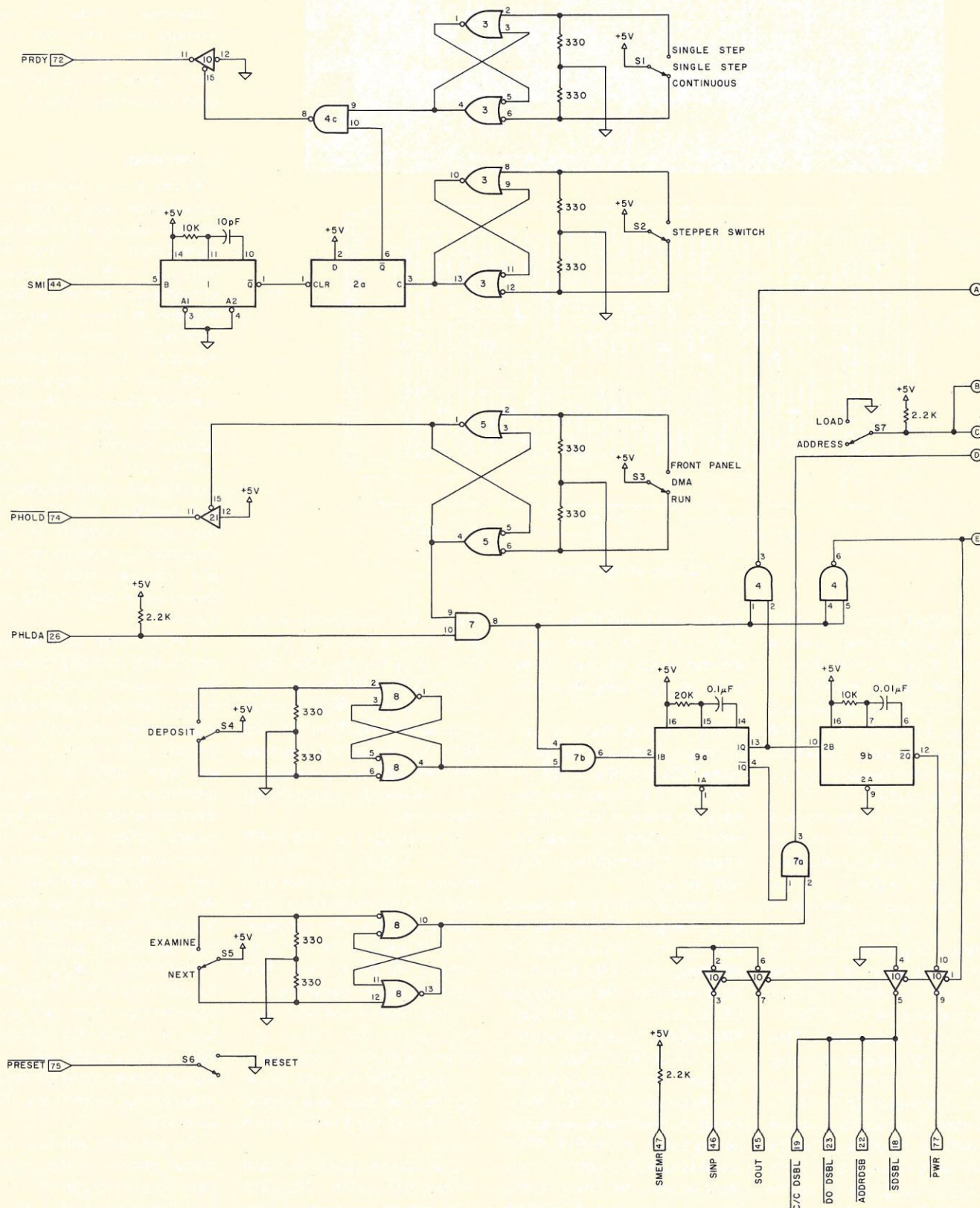
be phenomenal.

Checkout

Prior to applying power, use your ohmmeter to ensure that no Vcc-to-ground short exists. The supply connections to the

ICs in this project are all "at the corners," as is standard with TTL, so make sure they are connected to the appropriate bus.

With no other device in the system, power up the front panel. It should draw about 1



Amp at 5 V dc depending on how many LEDs are illuminated. With a voltmeter, check the enable pins of the Tri-state buffers of the address and data-out buses. These pins should be in the disabled or

high level. If this is the case, then it should be safe to plug in the CPU and memory cards. Be sure to remove power before inserting these cards, and bear in mind that the commercial boards require +8 V dc un-

regulated and have on-board regulators.

You can now perform a quick checkout and run a simple program at the same time. The program will add two binary numbers and store the result in a

memory location where it can be examined.

1. Set DMA switch to DMA mode and SINGLE STEP switch to CONTINUOUS mode. It may be necessary to activate the RESET switch to get a DMAG

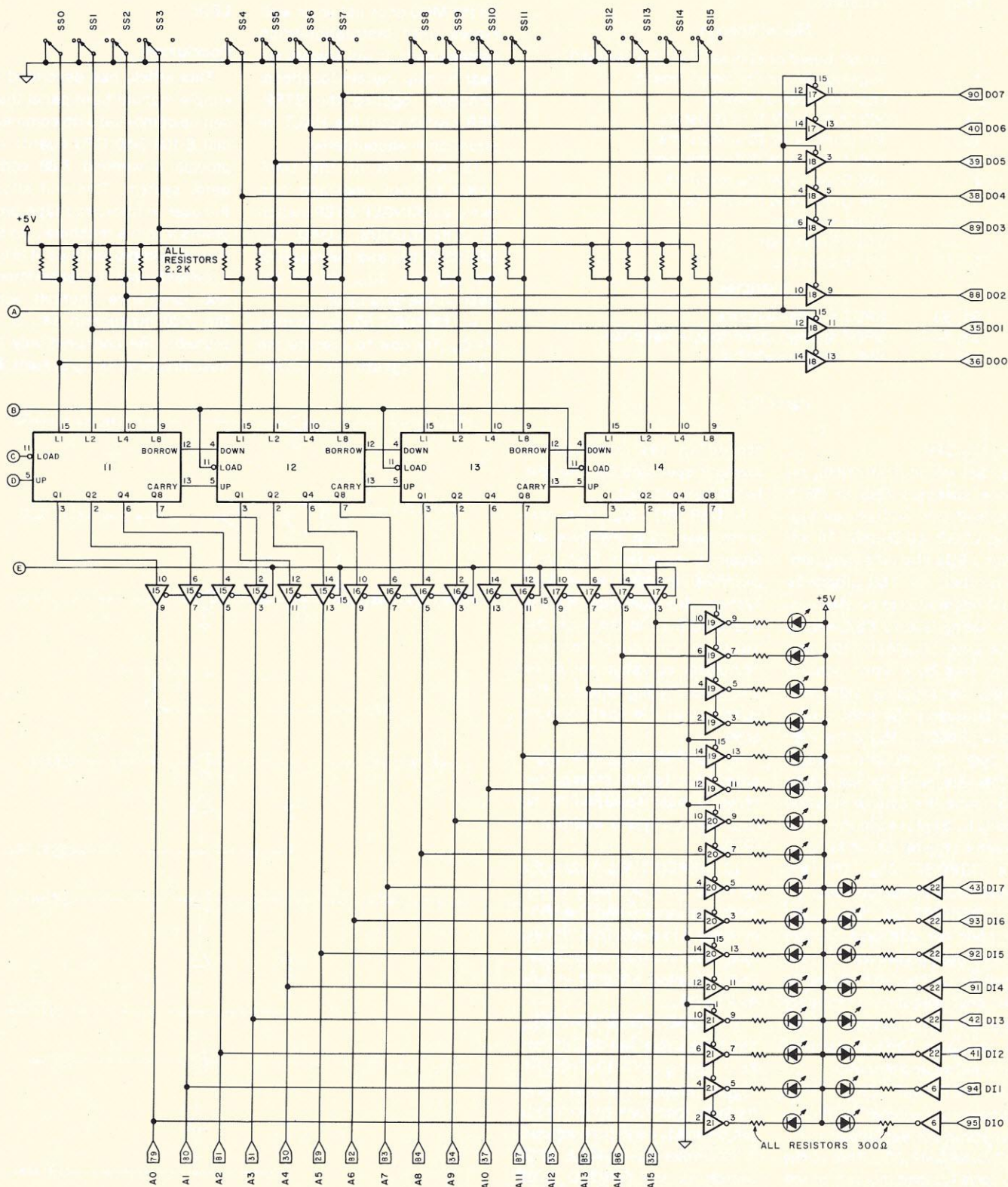


Fig. 1. Front panel.

ICs

1	74121
2	7474
3, 5, 8	7402
4	7437
6, 22	7404
7	7408
9	74123
10, 15-18	8T97
11-14	74193
19-21	74LS368

Miscellaneous

1	circuit board of choice 7" x 12" (see text)
1	edge connector for circuit board
24	LEDs MV5054 or similar
24	300 Ohm, 1/4 W 10% resistors
10	330 Ohm, 1/4 W 10% resistors
18	2.2K Ohm, 1/4 W 10% resistors
2	10K Ohm, 1/4 W 5% resistors
1	20K Ohm, 1/4 W 5% resistors
1	10 pF disk cap
1	0.01 uF disk cap
1	0.1 uF disk cap

Switches

S1, S3	SPDT toggle switches
S2, S4-7	SPDT spring-loaded toggle switches
SS0-15	SPDT toggle switches

Parts list.

from the CPU.

2. Set up address 0000₁₆ on sense switches SS0 to SS15 and load this address by toggling LOAD ADDRESS. All address LEDs should extinguish. Remember, all Z-80 programs must begin at zero on start-up.

3. Using SS0 to SS7, set up data byte 3E₁₆(00111110₂) and enter this byte into location 0000₁₆ by toggling DEPOSIT. The address LEDs should now indicate 0001₁₆. 3E₁₆ is the Z-80 op code for load accumulator immediate, and its execution will cause the byte in location 0001₁₆ to be placed in the accumulator register of the MPU.

4. DEPOSIT 08₁₆. The address should now read 0002₁₆.

5. DEPOSIT C6₁₆. This is the op code for add accumulator immediate and will result in the addition of the byte stored in the next sequential memory location to the contents of the accumulator. The result will remain in the accumulator.

6. DEPOSIT 08₁₆. This number will be added to the 08₁₆ already in the accumulator.

7. DEPOSIT 32₁₆. This is the op code for load memory immediate and will cause the contents of the accumulator to be

stored in the location in memory specified by the next two program bytes.

8. DEPOSIT 10₁₆. The low-order byte of a two-byte address is specified first in a Z-80/8080 system. In a 6800 system, the high-order byte is specified first. In our case, the address in which the accumulator contents are to be stored is XX10₁₆, where XX is specified in the next memory entry.

9. DEPOSIT 00₁₆. The high-order byte of our storage address is now specified to be 00₁₆. The complete address is 0010₁₆.

10. DEPOSIT 76₁₆. This is the op code for a software HALT; its execution will halt the MPU, causing it to execute NOPs (no ops) until interrupted or reset. The indicated address should now be 08₁₆.

11. LOAD ADDRESS 0000₁₆. The data LEDs should indicate 3E₁₆. Using EXAMINE NEXT, toggle through the first seven memory locations to verify the program you have just entered.

12. Place the SINGLE STEP switch in the SINGLE STEP mode, return DMA to RUN mode and activate the RESET.

The address indicators will show 0000₁₆ and the data LEDs will display 3E₁₆. Activate the STEPPER switch once. The address will now be 02₁₆ and data will be C6₁₆. Address 0001₁₆ will appear to have been skipped but, in fact, will have been accessed and 08₁₆ will have been loaded into the accumulator. As the MPU does not enter wait states until instruction-fetch cycles occur, it will always appear to skip certain locations. Continue toggling the STEPPER switch until the HALT instruction is encountered.

13. Now return the DMA switch to DMA mode and then move the SINGLE STEP switch to CONTINUOUS. LOAD ADDRESS 0010₁₆ and the result of the addition, 10₁₆, should appear on the data LEDs.

14. DEPOSIT 00₁₆ in location 0010₁₆. Try now to execute the same program in CON-

TINUOUS mode by moving the DMA switch to DMA and toggling RESET. The address indicator will show 0008₁₆, indicating that program execution is complete and the MPU has halted. Return the DMA switch to DMA and LOAD ADDRESS 0010₁₆. The result, 10₁₆, should once again appear on the data LEDs.

Conclusion

This article has described a simple manual front panel that can be combined with commercial S-100 Z-80 CPU boards to provide a working Z-80 computer system. This will allow the user to bootstrap tape programs into his machine and to develop simple routines. It is an excellent way to experiment and familiarize yourself with the Z-80 instruction set. It is probably the cheapest way to assemble a working system. ■

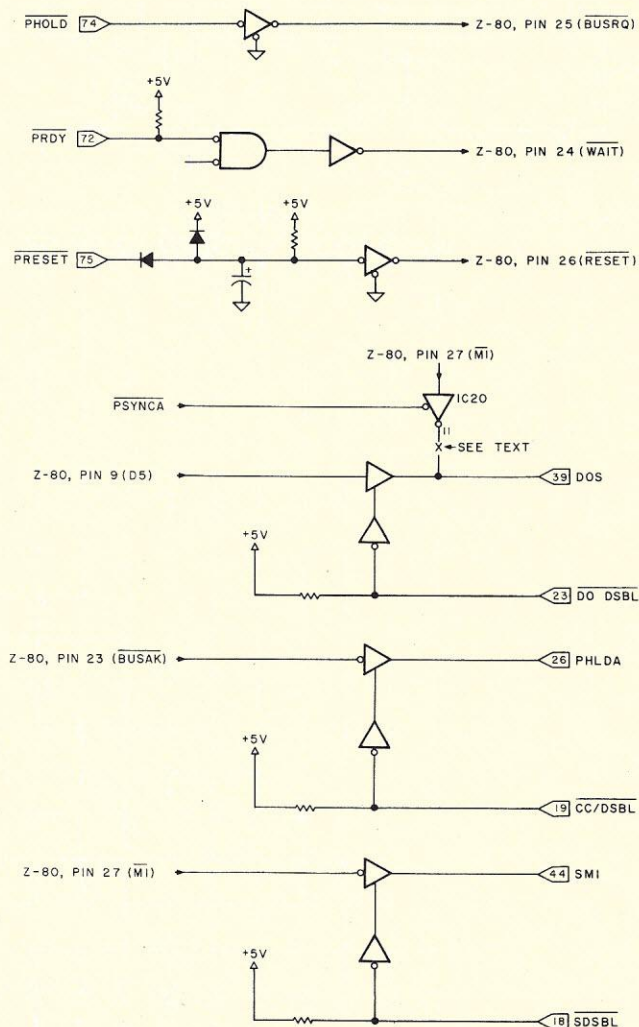


Fig. 2. S.D. Sales CPU card.

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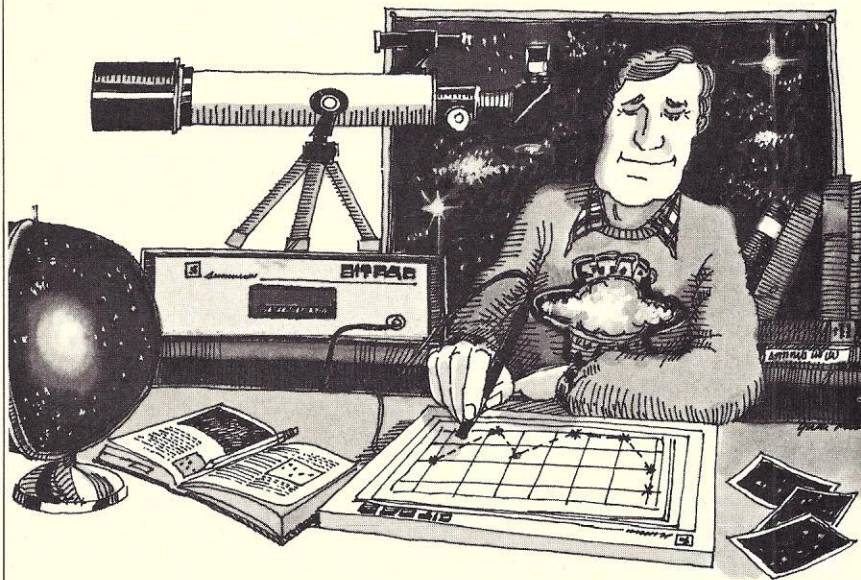
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A Strategy for Healthy Living

This computerized exercise/fitness program provides a systematic approach to getting—then staying—in shape.

Al's exerciser program has laid the groundwork for some really exciting possibilities. The next step is to have an analog-to-digital pulse counter so the computer can monitor the pulse continuously. And, along with that, speech output so the computer can tell you (as you exercise) if the pulse rate is high or low! — John.

Al Gerbens
1038 E. 6th Pl.
Mesa AZ 85203

Recently, in the process of surviving that ordeal known as a physical examination, I was introduced to a

book entitled *Total Fitness in 30 Minutes A Week* by Morehouse and Gross (Simon and Schuster, NY, 1975). I later purchased a copy, read it and began following much of the advice and direction it contains. Very briefly, building and/or maintaining

physical fitness is accomplished using three ten-minute exercise sessions per week. During each of these sessions you monitor your pulse rate and attempt to maintain it near a predetermined value. Each session requires more work to produce the same pulse rate as your condition improves.

Timing the segments in each ten-minute session and timing six seconds to obtain a pulse count turned out to be a pain in the neck. For example if you begin at 06:59:22 and time one minute, then you should stop at 07:00:22 and then begin timing the next two minute segment. It's now 07:02:22 and time to check pulse rate for six seconds while counting the beats. Then multiply the pulse count by ten in order to get the rate, and begin another two-minute countdown at 07:02:37. Let's see ... adding two minutes gives 07:04:37. ... It's really not all that complicated until you try it while concentrating on the exercises. I thought that programming our microcomputer to assist in timing and pulse rate determination would be an interesting application. Here is the result.

Exercise Program Functions

The program listed provides the functions of:

1. Reviewing the major concept of utilizing pulse rate as an effectiveness indicator.
2. Displaying the exercise sequence.
3. Calculating and displaying your training pulse rate based on your age.
4. Displaying that segment of exercise sequence to be accomplished next.
5. Timing each segment while displaying segment elapsed time on a video display in five-second increments.
6. Indicating when pulse rate determinations should be made.
7. Accepting 15 pulses that correspond to heartbeats, and

```

10 INPUT "HOW MANY DATA POINTS DO YOU HAVE?";W
20 FOR Z=1 TO W
30 # "ENTER THE NUMBER OF BEATS FOR POINT";Z
40 INPUT X(Z)
50 # "ENTER THE VALUE OF T FOR POINT";Z
60 INPUT Y(Z)
70 NEXT Z
80 # "DATA ENTRY COMPLETE"
90 FOR Z=1 TO W
100 H1=LOG(X(Z))*LOG(Y(Z))
110 H=H+H1
120 J1=LOG(X(Z))
130 J3=J3+J1
140 J2=LOG(Y(Z))
150 J4=J4+J2
160 K1=LOG(X(Z))*LOG(X(Z))
170 K=K+K1
180 L1=LOG(X(Z))
190 L2=L2+L1
200 M1=LOG(Y(Z))
210 M=M+M1
220 Q1=LOG(Y(Z))*LOG(Y(Z))
230 Q=Q+Q1
240 NEXT Z
250 J=(J3*J4)/W
260 L=(L2*L2)/W
270 B=(H-J)/(K-L)
280 A=EXP((M/W)-((B)*(L2)/W))
290 R2=((H-J)*(H-J))/((K-L)*(Q-(M*M/W)))
300 # "B=";B
310 # "A=";A
320 # "CORRELATION FACTOR = ";R2
330 # "USE THE FOLLOWING EQUATION FOR LINE 308 IN THE EXERCISER PROGRAM."
340 # "B1=INT(EXP((LOG('A;'T))/((-1)*('B;''))))"
350 END

```

Calibration routine.

acting as a frequency counter calculating and displaying your pulse rate.

8. Interpreting that pulse rate and recommending an increase or decrease in the rate of activity, including taking a break. Timing of any recommended breaks is automatically accomplished and

displayed.

Frequency/Pulse Rate Counter.

The pulse rate subroutine

begins in line 290. When called up the subroutine watches input port one for any change from 255, which it sees if all eight lines are left

RUN

EXERCISER

THIS PROGRAM PROVIDES THREE FUNCTIONS RELATED TO THE FIRST LEVEL EXERCISES DESCRIBED IN -TOTAL FITNESS IN 30 MINUTES A WEEK-BY L.E. MOREHOUSE.

THE THREE FUNCTIONS ARE SEQUENCE, TIMING AND PULSE RATE DETERMINATION.

TO CHECK PULSE RATE, FIRST LOCATE YOUR PULSE BY PRESSING AN INDEX FINGER AGAINST ONE TEMPORAL ARTERY AT THE SIDE OF YOUR FOREHEAD,(TEMPLE). USING THE OTHER HAND SHARPLY PUSH THE BUTTON IMMEDIATELY FOLLOWING EACH HEART BEAT. IF CORRECTLY ENTERED A SINGLE NUMBER WILL APPEAR ON THE SCREEN. AVOID HOLDING THE BUTTON DOWN TOO LONG. MULTIPLE ENTRIES CAN RESULT. 15 BEATS WILL BE ENTERED AND THEN YOUR PULSE RATE WILL BE AUTOMATICALLY DISPLAYED.

THE EXERCISE SEQUENCE IS

- 1) LIMBERING UP(1 MIN)
- 2) MUSCLE BUILDUP(4 MIN)
- 3) CIRCULO-RESPIRATORY CONDITIONING (5MINS)

THE REFERENCED TEXT SHOULD BE READ BEFORE PROCEEDING FURTHER.

WHAT IS YOUR AGE? 34
YOUR BEGINNING TRAINING PULSE RATE IS 111 BEATS PER MINUTE.

BEGIN WITH ONE MINUTE OF LIMBERING EXERCISES, SUCH AS

- 1) STRETCHING
 - 2) TWISTING
 - 3) BENDING
- EASY DOES IT. LIMBER UP SLOWLY.

START
5 SECONDS
10 SECONDS

[ETC.]

60 SECONDS
ONE MINUTE

NEXT UP, 4 MINUTES OF MUSCLE EXERCISES TO ADD MUSCLE TISSUE. DO 15 PUSH AWAYS AND THEN 15 SITBACKS IN APPROXIMATELY THE NEXT TWO MINUTES. THEN CHECK YOUR PULSE RATE.

[COUNTDOWN TWO MINUTES FIVE SECONDS AT A TIME]

NOW LETS CHECK YOUR PULSE RATE. PRESS THE BUTTON AFTER EACH BEAT. KEEP MOVING! PROCEED WHEN YOU ARE READY

1
2

[ETC.]

15
THANK YOU
RATE = 120 BEATS/MINUTE
GOOD, WITH A PULSE RATE OF 120
YOU CAN NOW REPEAT THE PUSH-AWAY AND SITBACK EXERCISES. 15 TIMES EACH; TAKE ABOUT 2 MIN.

[COUNTDOWN TWO MINUTES FIVE SECONDS AT A TIME]

NOW LETS CHECK THAT PULSE RATE.

PRESS THE BUTTON AFTER EACH BEAT. KEEP MOVING!
PROCEED WHEN YOU ARE READY.

1

2
[ETC.]

15

THANK YOU
RATE = 123 BEATS/MINUTE

SELECT ANY EXERCISE SUCH AS RUNNING IN PLACE. THE OBJECTIVE IS TO GET YOUR PULSE RATE UP TO 111 BEATS/MINUTE AND KEEP IT THERE FOR ABOUT FIVE MINUTES. BEGIN EXERCISING AND CHECK YOUR PULSE RATE IN ONE MINUTE
START

[COUNTDOWN ONE MINUTE FIVE SECONDS AT A TIME]

PULSE RATE CHECK AGAIN
PRESS THE BUTTON AFTER EACH BEAT. KEEP MOVING!
PROCEED WHEN YOU ARE READY

1

2
[ETC.]

15

THANK YOU
RATE = 153 BEATS/MINUTE
AT 153 BEATS/MIN. YOU SHOULD SLOW DOWN. CUT YOUR EXERCISE RATE TO ABOUT ONE HALF OF WHAT IT HAS BEEN FOR THE LAST ONE MINUTE. NOW CONTINUE EXERCISING FOR THE NEXT TWO MINUTES.

[COUNTDOWN TWO MINUTES FIVE SECONDS AT A TIME]

TIME FOR ANOTHER PULSE RATE CHECK. PRESS THE BUTTON AFTER EACH BEAT. KEEP MOVING!
PROCEED WHEN YOU ARE READY

1

2
[ETC.]

15

THANK YOU
RATE = 130
LETS CONTINUE. TWO MINUTES REMAIN IN THIS SESSION.

[COUNTDOWN TWO MINUTES FIVE SECONDS AT A TIME]

THIS SEQUENCE SHOULD BE REPEATED THREE TIMES PER WEEK. SEE YOU IN TWO OR THREE DAYS.
READY

Sample run.

Program listing (continued on following pages).

```

10 GOSUB318
12 # " EXERCISER"
14 # "
16 # "THIS PROGRAM PROVIDES THREE"
18 # "FUNCTIONS RELATED TO THE FIRST"
20 # "LEVEL EXERCISES DESCRIBED IN"
22 # "TOTAL FITNESS IN 30 MINUTES"
24 # "A WEEK- BY L.E. MOREHOUSE."
26 GOSUB314:GOSUB318
28 # "THE THREE FUNCTIONS ARE"
32 # "SEQUENCE, TIMING AND PULSE RATE"
34 # "DETERMINATION."
36 GOSUB314:GOSUB318
38 # "TO CHECK PULSE RATE, FIRST"
40 # "LOCATE YOUR PULSE BY PRESSING"
42 # "AN INDEX FINGER AGAINST ONE"
44 # "TEMPORAL ARTERY AT THE SIDE OF"
46 # "YOUR FOREHEAD. (TEMPLE)":GOSUB314
48 # "USING THE OTHER HAND, SHARPLY"
50 # "PUSH THE BUTTON IMMEDIATELY"
52 # "FOLLOWING EACH HEART BEAT."
54 GOSUB314

```



```

56 # "IF CORRECTLY ENTERED A SINGLE"
58 # "NUMBER WILL APPEAR ON THE"
60 # "SCREEN.":GOSUB314
62 # "AVOID HOLDING THE BUTTON DOWN"
64 # "TOO LONG. MULTIPLE ENTRIES WILL"
66 # "RESULT.":GOSUB314
68 # "15 BEATS WILL BE ENTERED AND"
70 # "THEN YOUR PULSE RATE WILL BE"
72 # "AUTOMATICALLY DISPLAYED."
74 GOSUB314:GOSUB318
76 # "THE EXERCISE SEQUENCE IS:"
78 # " 1) LIMBERING UP (1 MIN)"
80 # " 2) MUSCLE BUILDUP (4 MINS)"
82 # " 3) CIRCULO-RESPIRATORY"
84 # "  CONDITIONING (5 MINS)"
86 GOSUB314:GOSUB318
88 # "THE REFERENCED TEXT SHOULD BE"
90 # "READ BEFORE PROCEEDING FURTHER."
92 GOSUB314:GOSUB318
94 INPUT "WHAT IS YOUR AGE? ";A
96 A1=INT(.6*(220-A))
98 # "YOUR BEGINNING TRAINING PULSE"
100 # "RATE IS ";A1;" BEATS PER MINUTE."
102 GOSUB314:GOSUB318
104 # "BEGIN WITH ONE MINUTE OF LIMB-"
106 # "ERING EXERCISES; SUCH AS:
108 # " 1-STRETCHING"
110 # " 2-TWISTING"
112 # " 3-BENDING"
114 # "EASY DOES IT. LIMBER UP SLOWLY."
116 GOSUB314:GOSUB318
118 #TAB(12);"START"
120 FORX=1TO8:#"";NEXT
122 M=60:GOSUB264
124 #TAB(10);"ONE MINUTE"
126 GOSUB318
128 # "NEXT UP IS 4 MINUTES OF MUSCLE"
130 # "EXERCISES TO ADD MUSCLE TISSUE."
132 GOSUB314
134 # "DO 15 PUSHAWAYS AND THEN 15"
136 # "SITBACKS IN APPROXIMATELY THE"
138 # "NEXT TWO MINUTES. THEN CHECK"
140 # "YOUR PULSE RATE."
142 GOSUB314:GOSUB318
144 #TAB(10);"START"
146 M=120:GOSUB264
148 # "NOW LETS CHECK YOUR PULSE RATE"
150 GOSUB282
152 IF B1 > A1+20 THEN # "TAKE A MINUTE BREAKBEFORE CONTINUING."
154 IF B1 > A1+20 THEN156 ELSE164
156 # "KEEP MOVING AROUND DURING THE"
158 # "NEXT MINUTE TO IMPROVE BLOOD"
160 # "CIRCULATION":M=60:GOSUB264
162 GOTO168
164 # "GOOD, WITH A PULSE RATE OF"
166 #B1
168 # "YOU CAN NOW REPEAT THE PUSH-"
170 # "AWAY AND SITBACK EXERCISES. 15"
172 # "TIMES EACH; TAKE ABOUT 2 MIN."
174 GOSUB314
176 #TAB(10);"START":M=120:GOSUB264
178 # "NOW LETS CHECK THAT PULSE RATE."
180 GOSUB282
182 IFB1 < A1+20 THEN 192
184 # "YOUR PULSE RATE IS A LITTLE"
186 # "HIGH. TAKE A 30 SECOND BREAK"
188 # "BEFORE CONTINUING"
190 GOSUB314:M=30:GOSUB264
192 # "SELECT ANY EXERCISE SUCH AS"
194 # "RUNNING IN PLACE. THE OBJECTIVE"
196 # "IS TO GET YOUR PULSE RATE UP TO"
198 #A1;" BEATS/MINUTE AND KEEP IT"
200 # "THERE FOR ABOUT FIVE MINUTES."
202 GOSUB318
204 # "BEGIN EXERCISING AND CHECK"
206 # "YOUR PULSE RATE IN ONE MINUTE":GOSUB318
208 # "START":M=60:GOSUB264
210 # "PULSE RATE CHECK AGAIN.":GOSUB282
212 IF B1 < A1+20 THEN224
214 # "AT";B1;" BEATS/MIN. YOU SHOULD SLOW DOWN."
216 # "CUT YOUR EXERCISE RATE TO ABOUT"
218 # "ONE HALF OF WHAT IT HAS BEEN"
220 # "FOR THE LAST ONE MINUTE."
222 GOSUB314
224 IF B1 < A1-10 THEN# "PICK UP EXERCISE RATE IN ORDER TO BRING PULSE RATE UP TO ";A1;"BEATS/MIN."
226 GOSUB314
228 # "NOW CONTINUE EXERCISING FOR"
230 # "THE NEXT TWO MINUTES."
232 GOSUB314
234 M=120:GOSUB264

```

alone. Grounding one of these lines produces an input different from 255, and the program drops into another loop. You can momentarily ground one of the port one input lines by using a push button attached to a ten-foot cord, which allows you to move around during the pulse rate determination. It is important not to stand perfectly still during this process. According to the book, passing out cold is a possible consequence of remaining still immediately following exercise, and my computer's bag of tricks does not yet include administration of smelling salts or respiration-assistance capability. Enter each heart-beat as you feel it with one hand by momentarily pushing the button with the other hand. To feel your pulse, lightly press an index finger against one of your temporal arteries (located in the temple area of your head). *Never press both arteries simultaneously.*

To help prevent multiple entries caused by holding the button down for too long, each beat is displayed on the video screen as it is recorded. Try it a few times; it won't take long to get the hang of it. If you have trouble, two solutions are potentially helpful. 1. Increase the timing of the counting loop by changing the software. 2. Add some hardware in the form of a nonretriggerable one-shot between the push button and the input port.

Counter Calibration

Each time through the counting loop, the variable T is incremented. Calibration was not as easy as I expected, however, because the relationship between pulse rate and T turned out to be non-linear. After collecting a few data points and cranking them through linear and exponential curve fit routines, I obtained a 99.8 percent fit using the power curve $Y=AX^B$ line fit routine on an HP-65 programmable calculator. Realizing a lot of people don't have access to this resource, I've written a routine in BASIC that you can enter into your micro-computer for calibration of the counting loop on your system. Here's how to use it:

1. Enter the exerciser program, or just the counting loop if you prefer.
2. Collect three or more data points by entering known rates, which can be generated by carefully watching the sweep second hand of a clock. One pulse each second is 60 beats per minute, two pulses each second is 120 beats per minute and one pulse each two seconds is 30

beats per minute. Collect the value of T each time after the routine has counted 15 beats. Repeat each input rate about ten times and use the best eight determinations, throwing out the highest and lowest T value determination per rate.

3. Now enter the calibrating program listed with this article. It will ask you how many data points you have and then will ask you to input the values you have collected. The program then performs a line fit routine, matching the points to the general formula $Y=AX^B$, and generates a formula for a line on which the points fall. It then converts this formula into the format required in line 308 of the exerciser program. Watch R2; it is a goodness of fit value, and if it's not between .94 and 1.0, something is amiss.

4. Enter the output as line 308 in the exerciser program, and you're calibrated. Each time you enter a T value, a

B1 or heartbeat rate value will be calculated using that formula.

An alternative is to collect enough data points to build a lookup table into the program or alter the counter loop to produce a linear correlation.

The program occupies about 4.5K of RAM and is written in D.G. Maxi-BASIC Version 1.0. It is running on a Digital Group Z-80 system with a 2.5 MHz clock and 18K of RAM.

This is a unique application of a microcomputer in the home. Automatically inputting the heartbeat data using sensors such as strain gauges or force transducers is the next step. That's a hardware problem of no small magnitude at the home brew level, and would make an interesting project and article.

I strongly recommend you read and/or check with a physician before beginning any exercise program. ■

```

236 # "TIME FOR ANOTHER PULSE RATE CHECK."
238 GOSUB282
240 IF B1 > A1+20 THEN242ELSE246
242 # "BETTER SLOW IT DOWN, YOUR"
244 # "PULSE RATE IS TOO HIGH!":GOSUB314
246 IF B1 < A1-10 THEN248 ELSE250
248 # "PICK UP YOUR EXERCISE RATE!":FORX=1TO1E3:NEXT
250 # "LET'S CONTINUE. TWO MINUTES"
252 # "REMAIN IN THIS SESSION."
254 M=120:GOSUB264
256 # "THIS SEQUENCE SHOULD BE"
258 # "REPEATED THREE TIMES PER WEEK."
260 # "SEE YOU IN TWO OR THREE DAYS."
262 END
264 E=O
266 FORW=1TO50
268 E=E+5
270 FORX=1TO2800:NEXT
272 #TAB(10):E;" SECONDS"
274 FORX=1TO9: #"" :NEXT
276 IFE=M THEN EXIT280
278 NEXT W
280 RETURN
282 # "PRESS THE BUTTON AFTER EACH"
284 # "BEAT. KEEP MOVING!"
286 # "PROCEED WHEN YOU ARE READY"
288 T=O: B=O
290 X=INP(1)
292 IFX=255 THEN290
294 Y=INP(1)
296 T=T+1
298 IF Y <> 255 THEN B=B+1
300 IF Y <> 255 THEN #B
302 IF B=15 THEN306
304 GOTO294
306 # "THANK YOU"
308 B1=INT(EXP((LOG(85440.83/T)))/1.2237))
310 # "RATE=";B1;"BEATS/MINUTE"
312 RETURN
314 FORX=1TO 4E3:NEXT
316 RETURN
318 FORX=1TO16: #"" :NEXT
320 RETURN

```

THE MICRO WORKS

Give your 6800 computer the gift of sight! The Micro Works Digisector* opens up a whole new world for your computer. Your micro can now be a part of the action, taking pictures like this one to amuse your friends, watching your home while you're away, helping your household robot avoid bumping into walls, providing fast to slow scan conversion for you hams . . . the applications abound.

The Micro Works Digisector is a completely unique device; its resolution and speed are unmatched in industry and the price is unbeatable anywhere. The Digisector and a cheap TV camera are all you'll need to see eye to eye with your 6800. Since operation is straightforward, you don't have to be a software wizard to utilize the Digisector's extensive capabilities. The Micro Works Digisector board provides the following exclusive features:

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- Precision—64 levels of grey scale
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- Versatility—Accepts either interlaced (NTSC) or non-interlaced (Industrial) video input
- Compactness—Utilizes 1 I/O slot in your SWTPC 6800 or equivalent
- Economy—The Digisector is a professional tool priced for the hobbyist

The Digisector (DS-68), like all Micro Works products, comes fully assembled, tested and burned in. Only the highest quality components are used, and the boards are double sided with plated through holes, solder mask and silkscreen. All software is fully source listed and commented. The Micro Works is proud to add the DS-68 to its line of quality computer accessories for the hobbyist. Price 169.95

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regulated + 12 volts	104.95

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M31

A Tour of the Faire (Part 1)

Kilobaud's editor, John Craig, takes a look at some of the people and products that made up the San Jose show.

The Second West Coast Computer Faire. What a show! I always enjoy getting out for a good convention, and this one was no exception. It occurred to me that you folks who couldn't make it would also like a peek at what the show had to offer. Therefore, I took my camera along... and shot pictures like crazy! I sincerely hope you find it as interesting and entertaining as I did. As a matter of fact, I'd appreciate any feedback on how you feel about the effort... I was a little concerned with the length.

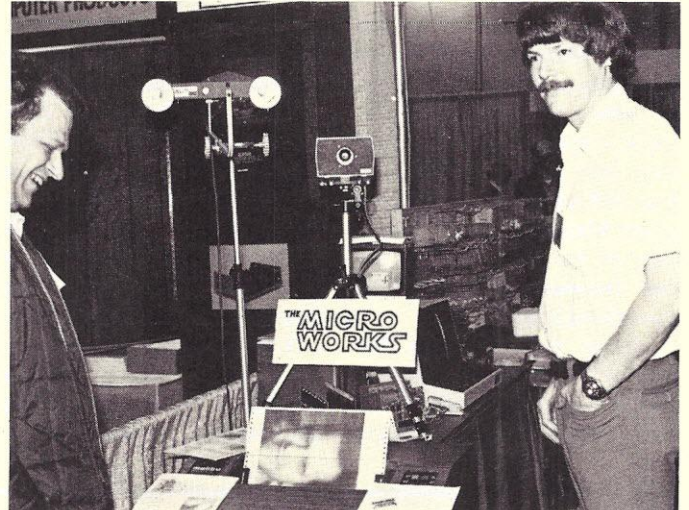
If you're looking for software for home or small business, you'll find it here. If you're looking for the latest in mass storage, you'll find that also. Terminals? You bet. New, low-cost systems—one or two. Boards and components... all over the place! Finally—some of those miscellaneous pieces of hardware you've been hoping someone would develop for your system. What the heck—mention that you saw it in *Kilobaud* when you drop a line to these companies, OK?

Not all is well in "photography land," I'm afraid. I shot seven rolls of film at the Faire. You're going to be seeing the results of *six* rolls... and I'm going to be looking for a new film processor! There are quite a few companies, large and small, who didn't make it into this write-up because of that goof—and I'm truly sorry.

Come along with me and I'll give you a grand tour of the Second West Coast Computer Faire... and, above all, *enjoy yourself!* ■



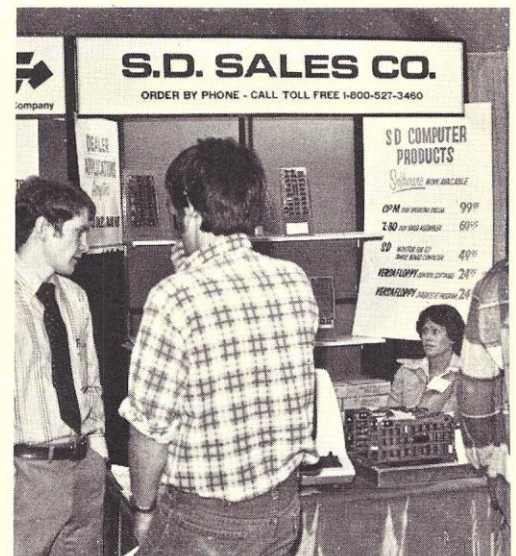
OK, TRS-80 owners, here it is: the first computer cassette "magazine." CLOAD Magazine arrives by first-class mail each month on a C-30 cassette... for \$24 a year. Should be interesting! PO Box 1267, Goleta CA 93017.



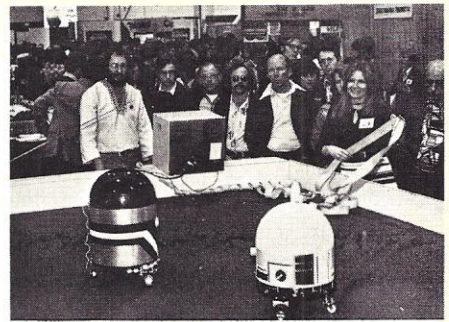
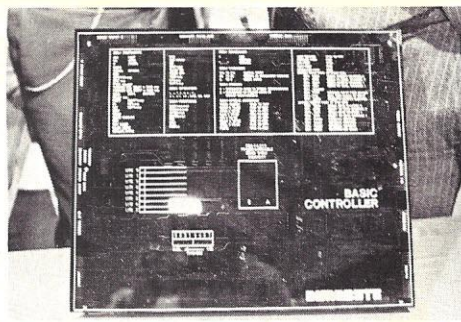
Bob Lentz, the president of Micro Works, is as pleased with the computer portrait system his company has developed as the gentleman on the left who just had his picture taken. (PO Box 1110, Del Mar CA 92014.)



Kinda show-offish, don't you think? Although it sure did the trick when it came to attracting crowds!



I keep hearing more and more good things about the service and products from S.D. Sales... and they sure were doing a brisk business at the Faire. Bet they'll send you their catalog if you write for it... or, better yet, just check their ads in *Kilobaud*.



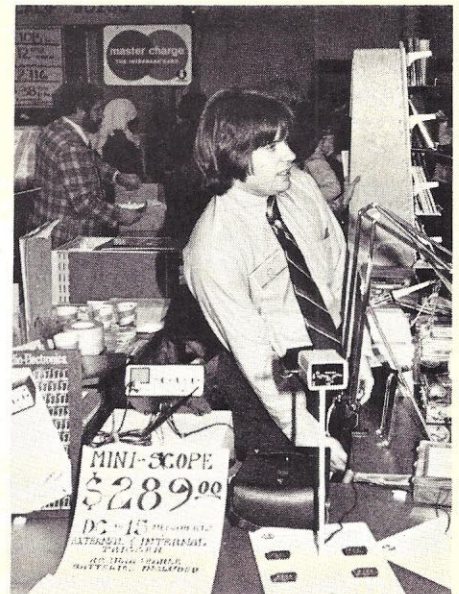
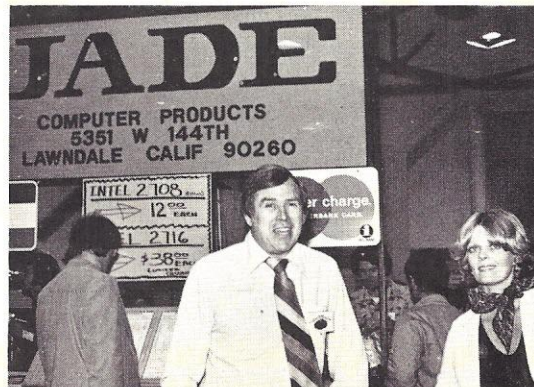
Is it Dynabyte . . . or dynamite? Let me tell you, these folks have some exciting things going! On the left we have Mike Watts, president of Dynabyte, standing in front of their Z-80 based dual minifloppy system . . . and their new double-sided, double-density Shugart floppy system. They have a rather unique dedicated-controller board (shown in the middle photo), which uses BASIC, which is why it's called a BASIC Controller. They were using the controller to run the two robots shown in the right photo, and they sure were a hit. (I think it was the robots that attracted the crowds . . . but it could have just as easily been Pam Farnsworth, the young lady minding the cables and the booth.) They have several other interesting products you might want to check into . . . drop 'em a line: 4020 Fabian Way, Palo Alto CA 94303.



What can I say? That staid, conservative gentleman on the left is the one and only Bill Godbout! (The mood of revelry was probably due to the tremendous success of his Econoram memory boards . . . and all the other items in his catalog!) The smiling face in the center belongs to none other than Carl Warren, the Senior Editor of Interface Age. The gentleman on the right? That's the real George Morrow. (Somebody who looks like George posed for the ad on page 128 of the April Kilobaud, but I know it wasn't really him because George always wears tennis shoes—and you'd never catch him with a tie on!) Godbout Electronics, Box 2355, Oakland Airport CA 94614.



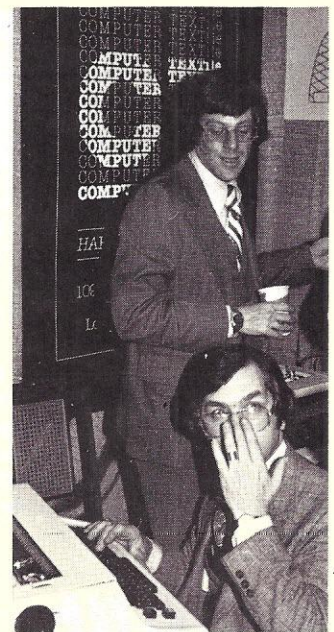
Hey, there he is. The handsome and debonair Dr. Lloyd Rice, creator of famous Computalker Voice Synthesizer. If you're in the market, give this one a listen before you buy. Computalker Consultants, PO Box 1951, Dept. K, Santa Monica CA 90406.



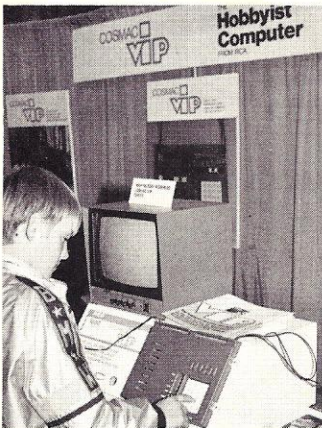
One of the busiest booths at the Faire had to be Jade Computer Products! The man behind all the action is Don Smith (shown in the center photo with his better half, Joanne). One of the latest products to be added to their line is the REX personal computer shown in the left photo. Don's "adopted son," Heath Kline, president of Priority One Electronics (10031 Woodley Ave., Sepulveda CA 91343), was sharing the booth—and showing off his MiniScope (and many other items). You cannot believe the incredible line of computer systems, components and peripherals Jade is carrying these days. Their spring catalog will make you drool! 5351 West 144th St., Lawndale CA 90260.



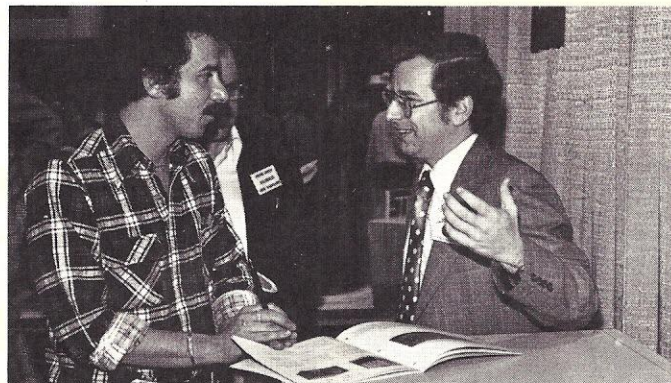
Tandy was there in force . . . with many new goodies for the TRS-80. Don French (merchandising mgr. for Tandy Computers) is behind the TRS-80 on the left. His head is directly above their new electrostatic screen printer, which sells for \$599 . . . and spews out printed copy at 2200 characters per second! They also had their new minifloppies and business systems line printer up and going (right photo). Be sure to send off for their new 1978 catalog . . . it looks like they're carrying every brand on the block! 1500 One Tandy Center, Ft. Worth TX 76102.



Would you buy a reconditioned Diablo (\$1995) or QUME-based terminal (\$2495) from that gentleman standing in the background? Sure you would, because he's Ken Widelitz, attorney-at-law, author of Kilo-baud's Legal/Business Forum and president of COMPUTER TEXTile, the company offering those terminals. 10960 Wilshire Blvd., Suite 1504, Los Angeles CA 90024.



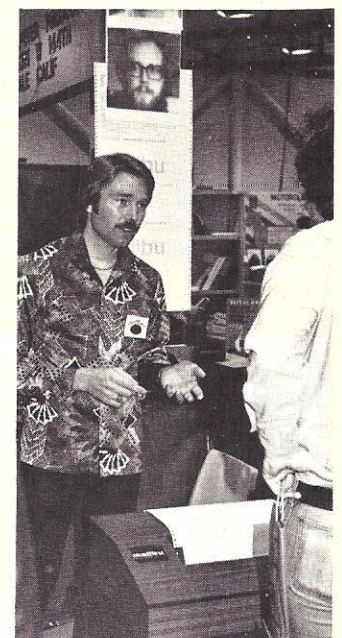
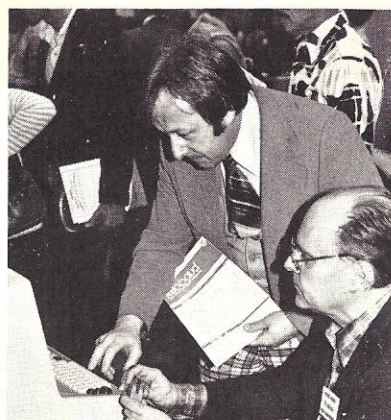
Hey, that RCA VIP (Video Interface Processor) is quite a little machine! The price is kind of high (\$275 kit), but it sure is a snap to create video patterns and games. I'd sure like to see it made a little more affordable because the 1802 has a lot going for it. RCA Solid State, Box 3200, Somerville NJ 08876.



I think I really captured the flavor of the moment here. The man on the left was a serious shopper who stopped by the Cromemco booth and hit Harry Garland (president of Cromemco) with some good questions about his system. As you can see, Harry thoroughly enjoys himself when it comes to answering such questions and pointing out the merits of his system. If you're shopping around, perhaps you should check into this "Cadillac" of S-100 systems. (Send for their new Spring Microcomputers/Peripherals catalog—\$1.) Cromemco, 2400 Charleston Rd., Mountain View CA 94043.



Dr. Curt Childress, president of Midwest Scientific Instruments, is on the left with Midwest's super 6800 system . . . and their new double-sided disk system. Curt borrowed a copy of Issue #10 of Kilo-baud and entered the Rugg/Feldman benchmarks; and he and Wayne Green are checking out the results in the photo on the right. At 1.6 MHz, the MSI 6800 came up with the following mind-blowing speeds: #1, .5 sec; #2, .5 sec; #3, 6 sec; #4, 10 sec; #5, 9 sec; #6, 12 sec; #7, 15 sec. Furthermore, the system can be run at even higher clock speeds! Their Catalog #2 is chock-full of 6800 boards, peripherals and whatever . . . send for it: 220 W. Cedar, Olathe KS 66061.



That's Mike Sherrick, the designer of the fantastic Malibu printer, and we have a review of the Malibu 160 in this month's issue. (One of their largest distributors is Jade Computer Products. Drop a line to Jade for more info.)



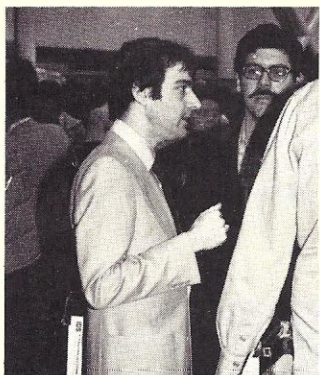
There seems to be an abundance of S-100 disk systems hitting the market, right? Well, in the course of shopping around, be sure to look over the capacity and software being offered with the Micropolis MetaFloppy and MacroFloppy drives. Their Extended Disk BASIC has file-management and programming capabilities, and they also have a 16K DOS. 7959 Deering Ave., Canoga Park CA 91304.



If you 6800 owners haven't checked into the line of SS-50 bus products from Smoke Signal Broadcasting then you're missing the boat! They have a DOS that supports from 1 to 3 of their minifloppies . . . patches for SWTPC BASIC . . . and a co-resident editor/assembler. They also have a 16K static memory board (\$529), and more. PO Box 2017, Hollywood CA 90028.



The Digital Group was demonstrating a graphics system that made a lot of mouths water.



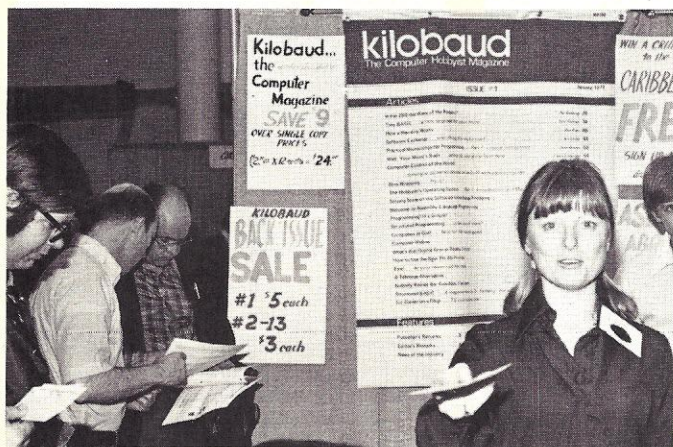
There he is, folks. The man behind the CP/M Users' Group: Tony Gold. Drop him a line . . . they've got twenty-four volumes (diskettes) in the library at this time! 164 W. 83rd St., New York NY 10024.



Here's the group from ALF: Greg Bloom, Philip Tubb (did you catch his "Incredizing" article in the April issue?) and Tim Gill. If you're into computer-generated music, these folks have some top-notch boards for the S-100 bus. Send for their catalog: 128 South Taft, Denver CO 80228.



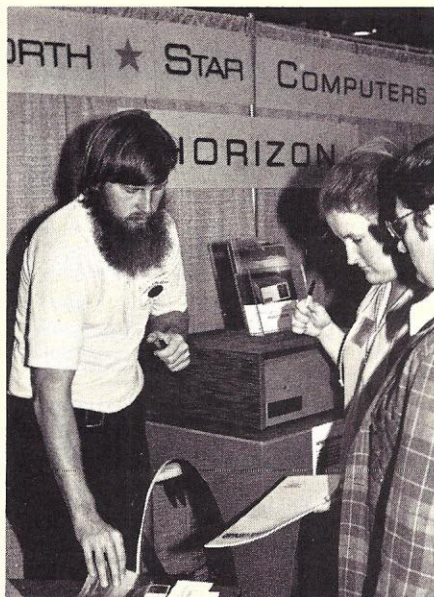
Isn't that a beauty? The new Bytemaster from the Digital Group . . . Z-80 based with either floppies (DISKMON OS) or Phi-decks (PHIMON). They have a complete product catalog now. PO Box 6528, Denver CO 80206.



For those of you who haven't had the opportunity to meet our executive vice-president, Sherry Smythe, then allow me to introduce her. Her son, Matt, is on the far right . . . and is one of the best booth managers in the business. (Unfortunately, we're going to have to do without his fine services for a couple of years while he goes down to Central America for some missionary work.)



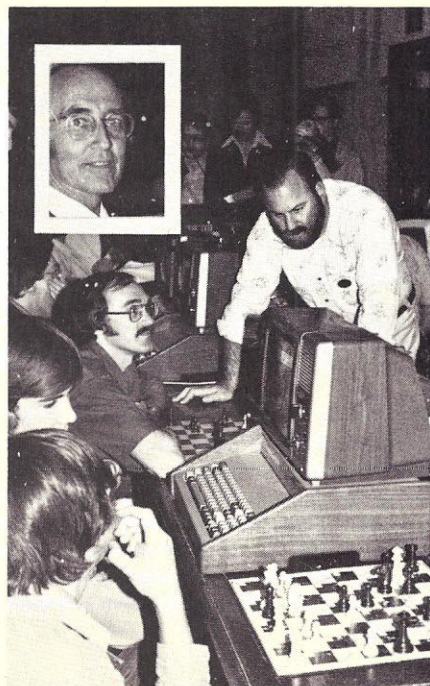
When it comes to quality S-100 systems, you're going to have to look far and wide before you find something comparable to the Equinox 100 . . . both electrically and mechanically. There were three factors that accounted for the tremendous crowds around the Thinker Toys/Parasitic Engineering booth: George Morrow's new floppy interface board, which can be configured for mini or standard-sized drives, the Equinox 100 and Lauren Kawakami. Thinker Toys, 1201 10th, Berkeley CA 94710—Parasitic Engineering, PO Box 6314, Albany CA 94706.



There's Chuck Grant, president of North Star Computers, with his arm resting on one of their Horizon systems. Keep your eyes open for a review of that system in an upcoming issue. With the wide-ranging use of North Star hardware and software these days, I suspect Chuck is quite pleased with what they've done. (I would have asked him, but he was too busy selling systems!) 2547 9th St., Berkeley CA 94710.



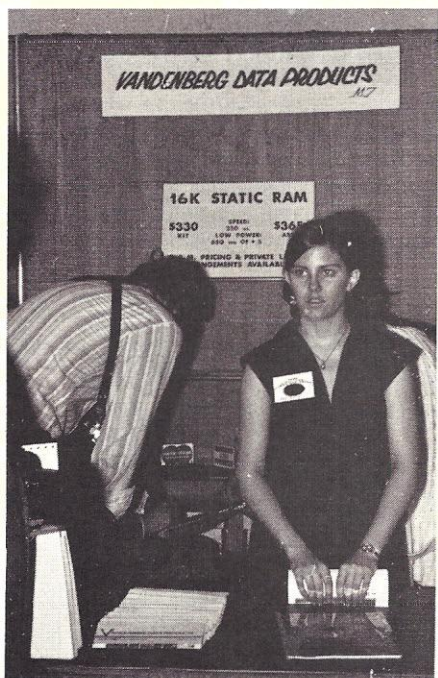
Why is this man smiling? Because he's Lou Frenzel, director of computer marketing at Heath, and he (along with everyone else at Heath) is tickled pink at the way their systems have taken off in sales. Now their floppies are here... and Heath's even happier! I can't tell you who that gentleman kneeling down (eyeing their new floppy system) is, but his initials are Steve Jobs! Drop a note to Heath and ask for their new catalog: Heath Co., Benton Harbor MI 49022.



Oh, yes... the chess tournament. What a crowd! I wasn't able to follow the action, but it was sure there. My friend, Doug Penrod (inset), played a big role in getting this event going through his "Computer Chess" newsletter (which will be a feature in Personal Computing magazine in the future).



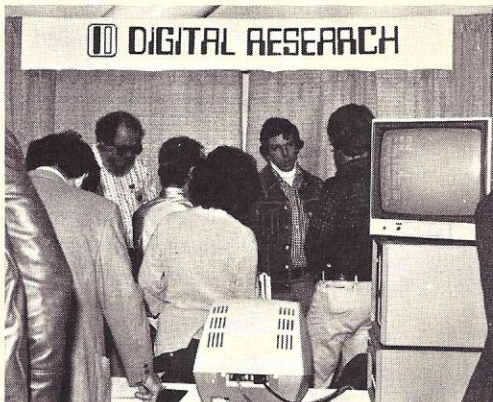
Who says the camera never lies? In this photo, Bob Mullen (guess which one) appears as a thoughtful, contemplative, handsome and debonair designer of the only S-100 logic-probe/extender board and relay/opto-isolator control board on the market; his partner, Keith Britton, appears to be awake! (Hey, check into their new logic-probe/extender board. It uses a 7-segment display, and does the job nicely!) Mullen Computer Products, Box 6214, Hayward CA 94545.



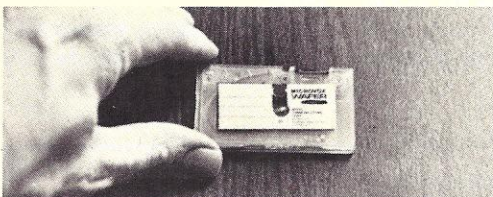
Becky Sallume, of Vandenberg Data Products, was one of the most lively "flyer-handè-outers" at the Faire; but this photo was taken at the end of the last day! If you're in the market for a 16K S-100 board that runs cool, then send VDP some of your hard-earned money (\$330 kit; \$365 assembled). PO Box 2507, Santa Maria CA 93454.



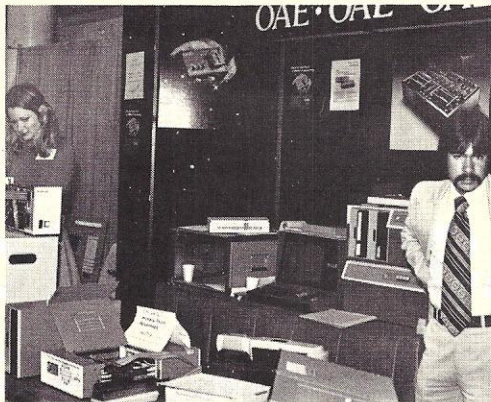
It never fails. At almost every computer convention you have at least one person go berserk and try to hit master reset and crash a system. I guess the strain was just too much for Nancy Millikin... and I sure hope she felt better after hitting that button! On the serious side, if you'd like some additional info on Meca's fantastic mass-storage system (with a voice prompt and response capability) write to them at: PO Box 696, 7026 Old Woman's Spring Rd., Yucca Valley CA 92284. (Ask for their mass-storage buyer's guide.)



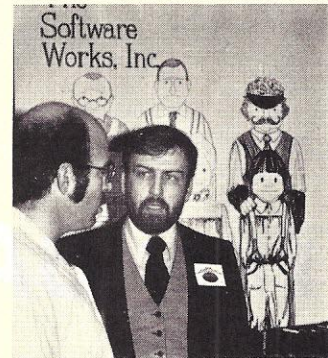
Wanna draw a crowd? Put up a Digital Research sign! I don't know whether you've noticed it or not, but there are two pieces of software playing a dominating role in this microcomputer industry; Microsoft BASIC... and Digital Research's CP/M Operating System! Heck, you can even get CP/M for the North Star drive (Lifeboat Associates, 164 W. 83rd St., New York NY 10024) and for the ICOM Frugal Floppy (Computer Mart of New Jersey, 501 Rt. 27, Iselin NJ 08830)! Digital Research has a new macroassembler and symbolic instruction debugger, both of which will be reviewed in an upcoming issue of Kilobaud. Version 1.4 of CP/M is out, too. Drop them a line for more info: PO Box 579, Pacific Grove CA 93950.



If you're in the market for a low-cost mass-storage system, then take a look at what the folks at Exatron have come up with! It's not called a cassette... it's a continuous-loop tape wafer (called the Stringy Floppy). Each wafer holds 40K bytes; and the transfer rate is an incredible 7200 kilobaud. Loads a 4K program in about 5 seconds. The system includes an S-100 controller board (with 4K monitor/assembler/editor) and the drive for \$289.50. (They also have a Tiny BASIC and a 5K BASIC available.) 1030 East Duane Ave., Suite I, Sunnyvale CA 94086.



Oliver Audio Engineering was looking good! Beautiful booth... and normally big crowds around it! By the way, did you know their new PROM programmer simply plugs into an existing PROM socket to do it's thing (read, program, verify and duplicate)? Two models—and they both sell for \$295. OAE, 676 West Wilson Ave, Glendale CA 91203.



If that dapper gentleman looks like Dick Milewski of The Software Works, there's a good reason for the resemblance! If you're looking for a North Star-based inventory-control program, they have one. (A review of the package is coming up in Kilobaud.) Drop them a line for more info: PO Box 4386, Mountain View CA 94040.



Hey... the folks at the Computer Room have a couple of beautiful business systems. The one Lawrence Grijalva is demonstrating in the photo is available with a cost-estimating package (for heavy-duty construction) and inventory control. They also have a Randall Data Systems machine with a BMI (Building Materials Industries) package... everything you need for running a lumber yard. 124 H Blossom Hill Rd., San Jose CA 95123.



Once again I managed to chase off the crowds for a second to grab a shot of Dan Meyer, president of Southwest Technical Products (sporting a new beard). They have a new dual-drive disk system (the DMAF1) for business applications that has a file management system called FLEX. (Oh, the drives are double-sided... 600K bytes each.) Send for their new catalog, and include \$.25, OK? Box 32040, San Antonio TX 78284.



TSC started off in the 6800 software business, but they're now offering some of the same packages (their text processing, in particular) in 8080 code. They would dearly love to send you a copy of their new '78 catalog. Technical Systems Consultants, Box 2574, W. Lafayette IN 47906.

Well, that should do it for this time. We'll finish up our little tour of the Faire next month with Part 2: more of the people and products.—John.

Tiny BASIC Shortcuts

Tom Pittman's Tiny BASICs (6502, 1802, etc.) are somewhat limited in capabilities. This is the first of several articles discussing methods to expand those capabilities.

Charles R. Carpenter
2228 Montclair Place
Carrollton TX 75006

Writing small but useful programs in Tiny BASIC (to paraphrase Tom Pittman) is a practical reality. Getting the most out of your programs is easier if you work with the inter-

preter's limitations. The utility program in Fig. 1 shows how to work with some of these limitations. This program is titled "Loans," but it could be any comparison of WHAT-IF alternatives. Here's what we'll be working with (and without):

- Decimal numbers not allowed.
- Number range limited from -32768 to +32767.

- 72 characters maximum on Input lines.
- Implied statements and abbreviations to save bytes of memory.

(Note: Tom Pittman now has an experimenter's manual available that explains many of these features and how to work with them. They are not as simple as my approach. The manual is available from Itty

Bitty Computers, PO Box 23189, San Jose CA 95153.)

These are not significant handicaps if you're estimating the effect of several alternatives. Round numbers are usually acceptable if you only want to get on base in some specific ball park (cliches are fun once in a while).

Byte-saving Tips

Saving bytes of memory is a practical approach if your computer has limited memory (I have 1250 bytes of free space now). Let's talk about the memory-saving part first.

Fig. 1 is an example of a program with no statement shortcuts; Fig. 2 uses all the implied and abbreviated statements possible in this Tiny BASIC interpreter. Memory in Fig. 1 is 492 bytes, an average of 17 bytes per line, while Fig. 2 uses 410 bytes for an average of 14 bytes per line. REM comments were added later and used 470 bytes.

Using implied statements causes the program to run

```

:
:LIST
10 REM TINY BASIC FOR KIM-1
11 REM 6502 V.1K BY T. PITTMAN.
12 REM
13 REM PROGRAMMED BY:
14 REM C.R. (CHUCK) CARPENTER W5USJ
15 REM 2228 MONTCLAIR PL.
16 REM CARROLLTON TX 75006
17 REM
18 REM THESE PROGRAMS ILLUSTRATE BYTE SAVING
19 REM TECHNIQUES IN LIMITED MEMORY SYSTEMS.
20 REM THE FIRST PROGRAM USED 492 BYTES. THE
21 REM OTHER USED 410 BYTES. AN INCREASE
22 REM (OR SAVING) OF 82 BYTES. IMPLIED
23 REM STATEMENTS AND ABBREVIATIONS ARE
24 REM THE REASON.
25 PR
26 PR
100 PRINT "LOANS : HOW MANY -"
110 INPUT N
115 PRINT
120 LET A=0
130 PRINT "INPUT: PRINCIPAL IN HUNDREDS (P)"
140 PRINT "      RATE IN PERCENT (R)"
150 PRINT "      TIME IN YEARS (T)"
160 PRINT "      PAYMENTS IN MONTHS (X)"
170 INPUT P,R,T,X
190 LET I=P*T*R
200 LET O=100*P+I
210 LET M=O/X
220 LET A=A+I
230 PRINT
240 PRINT "LOAN NUMBER -";A;" "
250 PRINT "INTEREST IS $";I
260 PRINT
270 PRINT "MONEY OWED IS $";O
280 PRINT
290 PRINT "PAYMENTS ARE $";M
300 PRINT
310 LET N=N-1
320 IF N>0 THEN GOTO 170
360 PRINT
370 PRINT "DONE"
380 PRINT
390 END
:
:
:
:
:I=0
:1 I=I+2
:2 GOSUB 1
:RUN
:226 AT 1
:END
:PRINT "THERE ARE ";I;" BYTES LEFT"
THERE ARE 288 BYTES LEFT
:

```

Fig. 1. First program version using no shortcuts to write the program or save bytes. This program uses 492 bytes, exclusive of the REM statements. REM statements use 470 bytes. The short routine above illustrates how Tiny BASIC finds the number of bytes of free space remaining. The user's manual tells how to do it.

slower, but the increase in program lines is worth the loss of speed (if speed is your concern then Tiny BASIC may not be for you, anyway). Memory saving wasn't really necessary for this short program; but in a 100-line program over 200 bytes could be saved (12 to 15 lines' worth). Such significant savings allow you to write longer programs. The programs are still small, but even a few more lines make them more useful. And that's what we're trying to do. Bytes could be saved in a few more places, such as the spaces in the print input, lines 130 through 160, but in the interest of clarity, I left them alone.

Decimal Values

Calculations involving decimal numbers can be handled several ways. Anytime a percentage or a calculation resulting in a fraction occurs, a decimal number results. Dollars and cents are decimal numbers, too. Tiny BASIC truncates decimal numbers down to the next lower whole number. If the number is less than one, the result is zero. (For this

reason, accountants would probably not want to use Tiny BASIC.)

Lines 130 through 180 are the input lines for this program. I used principal in hundreds and rate in percent to avoid decimal percentage entry and to prevent dividing percent by 100 (to get back to a decimal percentage). The math comes out right when it's printed out in line 250. I then multiplied the total loan value by 100 in line 200 to make the right amount print in lines 270 and 290.

Principal input in hundreds also helps avoid the number-limitation problem. Keeping the numbers to be operated on small limits precision but keeps the multiplication results in range. Adding a statement in a print line to multiply (or divide, etc.) by some factor will put the answer back in the right magnitude. This is sort of like using engineering notation with a slide rule. The difference is the lack of decimal numbers.

An input-line limitation of 72 characters restricts the amount of data you can input. Two character spaces are used

by the prompting question mark and following space. This reduces actual data input to 70 characters, including the required commas between the data entries. With the loan amount in hundreds, I was able to input values for six loans instead of five. To overcome the limited data-input situation, write programs that will perform calculations, hold the results and return for more

data. I've done this on some data-processing routines with good results.

There's another way to accommodate more data than the line will hold. Simply input as many loan numbers (or WHAT-IFs) as needed in line 100. When the program has used the data entered, it will ask for more until the number of N entries is reached in line 320. Question marks will show up each time

:LIST

```

100 PR"LOANS : HOW MANY -"
110 INPUT N
115 PR
120 A=0
130 PR"INPUT: PRINCIPAL IN HUNDREDS (P)"
140 PR"      RATE IN PERCENT (R)"
150 PR"      TIME IN YEARS (T)"
160 PR"      PAYMENTS IN MONTHS (X)"
165 PR
170 INPUT P,R,T,X
190 I=P*T*R
200 O=100*P+I
210 M=O/X
220 A=A+1
230 PR
240 PR"LOAN NUMBER - ";A;" "
250 PR"INTEREST IS $";I
260 PR
270 PR"MONEY OWED IS $";O
280 PR
290 PR"PAYMENTS ARE $";M
300 PR
310 N=N-1
320 IF N>0 GOTO 170
360 PR
370 PR"DONE"
380 PR
390 END

```

Fig. 2. Second program version using implied statements and abbreviations to save bytes. This version uses 410 bytes.

LOANS : HOW MANY -
?6

INPUT: PRINCIPAL IN HUNDREDS (P)
RATE IN PERCENT (R)
TIME IN YEARS (T)
PAYMENTS IN MONTHS (X)

?40,10,3,36,40,12,4,48,40,18,5,60,50,10,3,36,50,1
2,4,48,50,18,5,60

LOAN NUMBER - 1
INTEREST IS \$1200

MONEY OWED IS \$5200

PAYMENTS ARE \$144

LOAN NUMBER - 2
INTEREST IS \$1920

MONEY OWED IS \$5920

PAYMENTS ARE \$123

LOAN NUMBER - 3
INTEREST IS \$3600

MONEY OWED IS \$7600

PAYMENTS ARE \$126

LOAN NUMBER - 4
INTEREST IS \$1500

MONEY OWED IS \$6500

PAYMENTS ARE \$180

LOAN NUMBER - 5
INTEREST IS \$2400

MONEY OWED IS \$7400

PAYMENTS ARE \$154

LOAN NUMBER - 6
INTEREST IS \$4500

MONEY OWED IS \$9500

PAYMENTS ARE \$158

DONE

Fig. 3. Sample run. Simple interest calculations of two different loan values at three rates.

From Fig. 3

Simple Int

Interest%	Years	Amount
1. 10	3	\$5200.00
2. 12	4	5920.00
3. 18	5	7600.00

From Fig. 5

Compound Int

Equiv-Int%	Years	Amount
11	3	\$5320.00
15	4	6400.00
26	5	9200.00

Mult	Actual Loan Value	Difference
1. 1.331	\$5324.00	+\$ 4.00
2. 1.574	\$6296.00	- 104.00
3. 2.288	\$9152.00	+ 48.00

Fig. 4. For a loan of \$4000.

line 170 runs out of data and line 320 is still greater than zero.

This program only calculates simple interest loans. Compound-interest calculations require decimal numbers and raising numbers to some power. The multiplier for compounding over n periods is $(1 + I)^n$, where I is the interest expressed as a decimal and n is the number of years (or periods).

You can use this multiplier to calculate the approximate equivalent while percentage over the term of the loan. Your calculated answer will result in a much more realistic loan evaluation. I made some of these calculations, and Fig. 4 has some examples.

In the program itself, there are no unusual or unique programming techniques. There are two counting loops—one starting at line 110 and the other at line 120. Whatever

value is input for N is decremented in line 310 until the data sets, input in line 170, are used up. The counter that starts in line 120 numbers the printed output each time a pass through the program is completed.

I tried to use N to do both, but could not without using more program lines. Otherwise, this is simply a fundamental program with input between lines 100 and 170, calculations between lines 190 and 220 and output between lines 240 and 290.

Summary

It is easy to save bytes of memory if you remember to use implied statements and statement abbreviations. The user's manual for Tiny BASIC shows what is, and is not, allowed. Both the decimal number and number range limitation can be handled by using software math techniques (multipliers, dividers, engineering notation,

etc.). Line input characters limited to 70 (72 with prompting question mark and space) can also be handled by programming techniques.

Remember, if you input more than a total of 72 characters in a single line, the program will stop. Nothing more will happen

until you reset your system. If you have to reset and want to save the program already in memory, then reenter the interpreter at the soft entry point. The Tiny BASIC user's manual explains how to do this, too. A program does not have to be big to be useful. ■

LOANS : HOW MANY -
?3

INPUT: PRINCIPAL IN HUNDREDS (P)
RATE IN PERCENT (R)
TIME IN YEARS (T)
PAYMENTS IN MONTHS (X)

? 40,11,3,36,40,15,4,48,40,26,5,60

LOAN NUMBER - 1
INTEREST IS \$1320

MONEY OWED IS \$5320

PAYMENTS ARE \$147

LOAN NUMBER - 2
INTEREST IS \$2400

MONEY OWED IS \$6400

PAYMENTS ARE \$133

LOAN NUMBER - 3
INTEREST IS \$5200

MONEY OWED IS \$9200

PAYMENTS ARE \$153

DONE

Fig. 5. Loan value two, rerun to show the effect of compound interest on the total loan value. Compare the results with the simple interest calculation.

North Star Software

Maillist

Maillist is a general purpose mailing label program capable of producing formatted lists for tractor-fed or Xerox type labels. Maillist will also sort lists for any field.

Price \$39.95 on diskette with manual/stock to 14 day delivery.

In-out driver

Dos in-out driver is designed to set up mapped memory video boards in conjunction with hard copy device. The user may switch output under software control. Any file directory may be listed while in BASIC without jumping to dos. Spacebar will stop output for line by line listings. Designed for use with 3P+S and any tv board.

Price \$12.95 on diskette with manual/stock to 14 day delivery.

Register

Register is a cash register and inventory control program. The software will control a point of sale terminal and printer. It will search inventory for an item, price and ticket it. Register has provisions for min-max, automatic reorder, and critical list.

Price \$299.95 on diskette with manual.

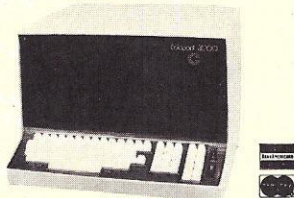
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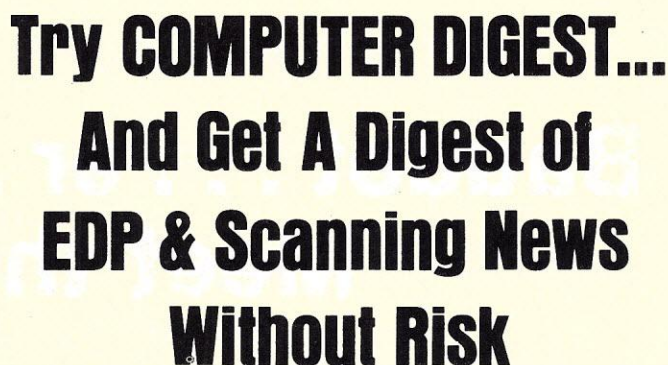
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KB/6/78

Baudot . . . er . . . Murray, Meet the H8

There is an inexpensive way of obtaining reliable and quiet hard copy for your home system; and an old five-level code teletypewriter is the answer.

Publisher's note: *The Baudot referred to in this article is actually Murray code as per my remarks on page 4. Have we all been the victim of a dastardly French revisionism plot?*

Baudot teleprinters, frequently available as surplus for next to nothing, can be used with the driver described here as a listing device for your

H8 system. Baudot printers use five information bits, rather than the seven bits used by ASCII printers, to print 52 characters. Even though ASCII teleprinters can print many more characters than Baudot machines, there are only a few programming characters lacking in the five-level printer.

By assigning arbitrary sym-

bols to cover the desirable ASCII characters not available in the Baudot set, the missing characters can be accommodated. The following assignments have been made in this driver:

Back Space	=	X
Percent (%)	=	(C)
Asterisk (*)	=	(X)
Plus (+)	=	(P)
Less Than (<)	=	(L)
Equal (=)	=	(E)
Greater Than (>)	=	(G)
At (@)	=	(A)
Left Bracket ([)	=	(B)
Reverse Slant (\)	=	(R)
Right Bracket (])	=	(B)
Up Arrow (^)	=	(U)
Underline (_)	=	(-)

You can make arbitrary assign-

ments by modifying the lookup table used in the driver program to convert ASCII characters generated in the computer to Baudot characters.

Hardware

The ASCII/Baudot driver was written for the Heath H8 computer system. This documentation assumes that the interface to the teleprinter will be made via an H8-2 parallel I/O port. Since Heath software makes no distinction between serial and parallel ports, an H8-5 serial port can be used. However, you will normally have a CRT console already connected to a serial I/O port, with the second port on the board automatically committed to the

Integrated Circuits

U1	AY-5-1013A	UART	-12 Required on Pin 2
U1 (Alt.)	AY-3-1015	UART	-12 Not Required
U2	NE555V	Timer	
U3	SN7404N	Hex inverter	

Resistors

R 1	18k, 1/4 W	
R 2	50k, 10 Turn	Potentiometer
R 3	47k, 1/4 W	
R 4	1k, 1/4 W	

Capacitors

C 1	.01 uF Disk Ceramic
C 2	.01 uF Polystyrene (High Stability)

Power Supply (not shown)

A power supply capable of providing +5, -12, and Loop current (if required) is necessary to operate the interface circuitry. A suitable supply, having, in addition to the above, a +12 volt regulator, loop keying transistor, transformer and solid state motor control relay, is available in fit form from Eclipse Communications, 5 Westwood Drive, San Rafael CA 94901. The RP-400 Power Supply Kit can be obtained for \$71.25 (plus tax in California) plus \$2 postage and handling.

Table 1. Interface parts list.

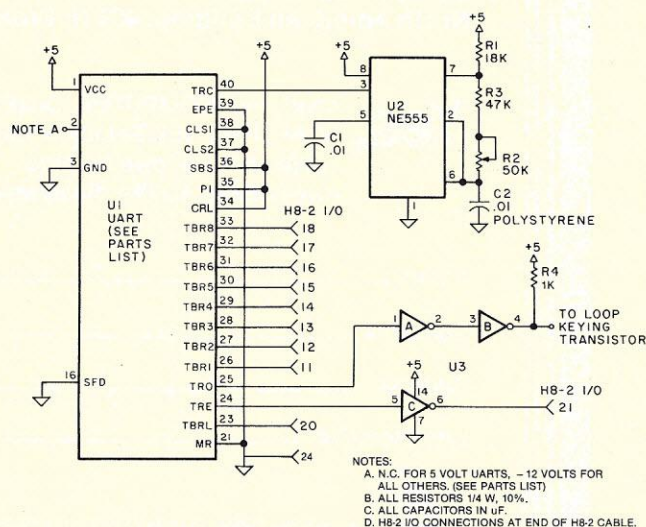


Fig. 1. H8-2 to external UART interface.

H8-2 Interface

Function	Pin	Wire Color
Data 0	1	White-Black
Data 1	2	White-Brown
Data 2	3	White-Red
Data 3	4	White-Orange
Data 4	5	White-Yellow
Data 5	6	White-Green
Data 6	7	White-Blue
Data 7	8	White-Violet
Ground	9	White-Gray
Data Taken	10	Red-Black
Take Data	11	Red-Yellow
Device Cntrl	12	Red-Green
Device Rdy	13	White-Black-Red
Device Cntrl	14	Pink
Send Data	15	Tan
Data Sent	16	White
Ground	17	Gray
Data 7	18	Violet
Data 6	19	Blue
Data 5	20	Green
Data 4	21	Yellow
Data 3	22	Orange
Data 2	23	Red
Data 1	24	Brown
Data 0	25	Black

UART Interface

Signal Flow	Pin	Function
→	11	TBR1
→	12	TBR2
→	13	TBR3
→	14	TBR4
→	15	TBR5
→	16	TBR6
→	17	TBR7
→	18	TBR8
→	24	GND
←	21	TRE
→	20	TBRL

Table 2. H8-2 to UART interface.

in the same way as for an H10.

Software

The ASCII/Baudot driver uses a lookup table to convert the ASCII character being sent to the system console to a Baudot character compatible with a five-level teleprinter. The routine is placed at the upper end of user RAM, just below the stack, where provisions have been included in Heath software to allow user memory space.

The Heath software must be reconfigured to allow the ASCII/Baudot driver to be used. The changes include: (1) redefining the high-memory limit as detailed in Table 3; (2) changing five memory locations in each Heath program, as shown in Table 4.

Once the Heath software has been reconfigured, the ASCII/Baudot routine is loaded with the Heath program. The ASCII/Baudot driver need only be loaded once when going from one Heath reconfigured pro-

cassette tape I/O. A second serial I/O board could be used, but an unusable tape I/O port would result.

A universal asynchronous receiver transmitter (UART), hex-inverter integrated circuit, Baudot clock and 60 mA loop circuitry are required to complete the interface. A schematic and parts list for this out-board circuitry are given in Fig. 1 and Table 1, respectively.

The baud-rate potentiometer, R2, should be adjusted to a frequency 16 times the teleprinter baud rate. If the teleprinter has 60 wpm gears, the clock rate should be 727 Hz; if the machine has 100 wpm gears, the baud-rate clock should be adjusted to 1187 Hz.

Table 2 shows the connections that must be made between the interface circuitry and the H8-2 parallel I/O connector. The parallel I/O cable is wired as recommended by the H8-2 parallel I/O manual for the H10 tape reader/punch. Finally, the jumpers on the parallel I/O channel should be configured

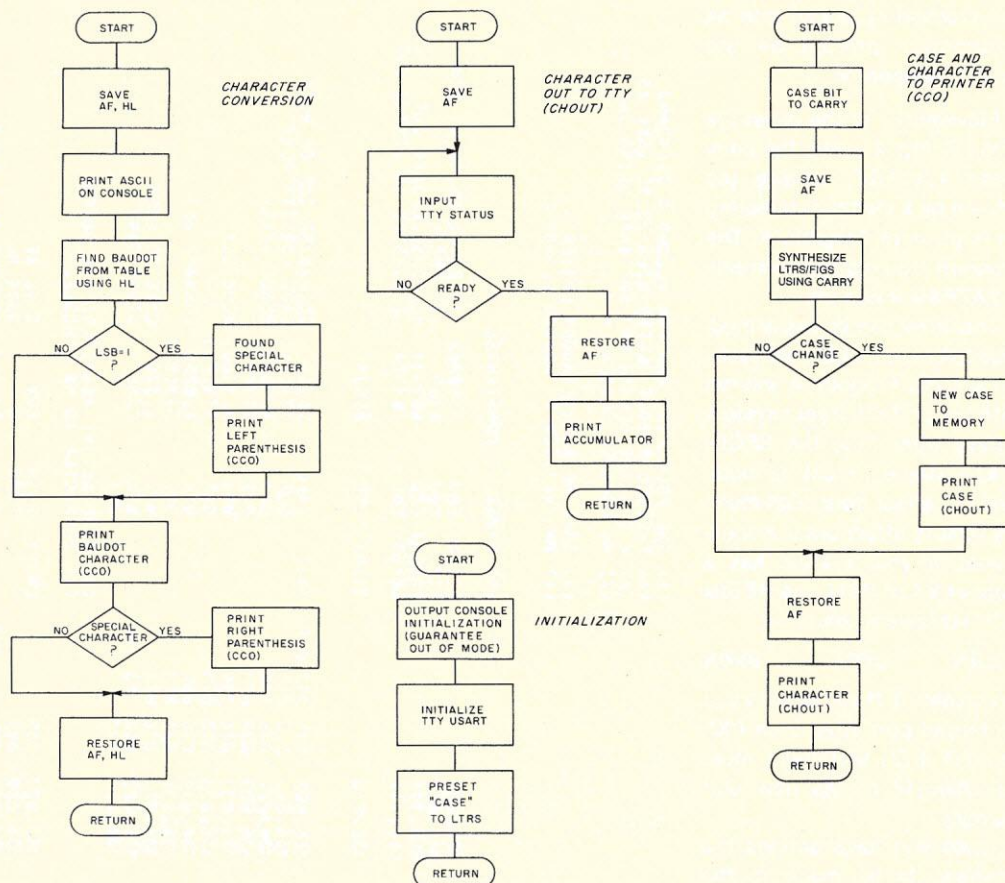
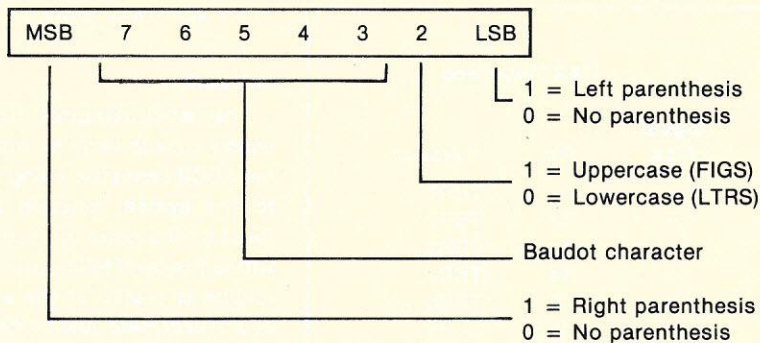


Fig. 2. Program flowcharts.



Examples:

1. Assume A is the ASCII character. Binary byte for A is 00001100. Octal equivalent of binary byte is 1400. Baudot machine prints A.
2. Assume = is the ASCII character. Binary byte for = is 10000101. Octal equivalent of binary byte is 2050. Baudot machine prints (E).
3. Assume 5 is the ASCII character. Binary byte for 5 is 01000010. Octal equivalent of binary byte is 1020. Baudot machine prints 5.

Fig. 3. Lookup table byte structure.

gram to another. For example, the following describes a typical use of the driver with the H8 editor and assembler.

1. Load ASCII/Baudot driver from cassette tape.
2. Load reconfigured H8 editor.
3. Push GO. The Baudot printer will now print each character sent to the CRT, with substitutions where required.
4. Write and/or edit source code.
5. Save source code on cassette tape.
6. Load reconfigured H8 assembler.
7. Push GO. The assembly will proceed normally, with all information printed on the Baudot teleprinter.

Flowcharts for the driver are given in Fig. 2, while the complete assembly listing (as printed by a model 28 teleprinter) is given in Program A. The program requires approximately 270 RAM locations.

The driver can be easily modified to be compatible with your H8 system. Program A will run with 16K of RAM. If your system differs from this, the BEGIN EQU statement must be modified to reflect your high-memory limit in offset octal. For example, if your system has a total of 8K of RAM, the BEGIN EQU statement would be:

```
BEGIN EQU 76000A
```

from Table 3. If you wish to use an output port other than 700, the TTY EQU statement must be changed to the new port number.

Once you have defined the changes to be made to the ASCII/Baudot driver, the source-code listing can be changed

1. Load Distribution Tape.
2. Change High Memory using Reconfigured High Memory below.
3. Change Pad from 4 to 1 (optional).
4. Record Heath program using "SAVE."
5. Proceed to instructions on Table 4.

Total User RAM	Actual Decimal Limit	Actual Octal Limit	Begin Equ	Reconfigured High Memory
4K	12287	057377A	056000A	11775
8K	16383	077377A	076000A	15871
12K	20479	117377A	116000A	19967
16K	24575	137377A	136000A	24063
20K	28671	157377A	156000A	28159
24K	32767	177377A	176000A	32255
28K	36863	217377A	216000A	36351
32K	40959	237377A	236000A	40447

Table 3. Reconfiguring Heath programs.

```

(X) THE FOLLOWING PROGRAM ALLOWS A STANDARD
(X) 5-LEVEL BAUDOT TELEPRINTER TO BE USED AS
(X) A LISTING DEVICE FOR SOFTWARE USING THE
(X) H8 CONSOLE DRIVER, V 1.1.
(X) THIS H8 ASCII/BAUDOT DRIVER
(X) WAS WRITTEN BY HOWARD L. NURSE.

(X) SYMBOLIC CONSTANTS:
BEGIN EQU 136000A 511 BYTES BELOW HI MEM
TTY EQU 0700 TTY PORT
$COUT EQU 40111A H8 CONSOLE DATA OUT
$CISO EQU 40117A H8 CONSOLE IN STATUS OUT
START ORG BEGIN

INIT CALL $CISO GUARANTEE OUT OF MODE
OUT TTY(P)1 SAME FOR TTY PORT
MVI A,1000 RESET USART
OUT TTY(P)1
MVI A,1160 MODE SET
OUT TTY(P)1
MVI A,0050 COMMAND SET
OUT TTY(P)1
MVI A,370 CASE TO LTRS
STA CASE
RET

(X) SAVE ACTIVE REGISTERS AND OUTPUT
(X) CHARACTER TO H8 CONSOLE.
ENTRY PUSH PSW SAVE AF
PUSH H SAVE HL
CALL $COUT CONSOLE CHARACTER

(X) CONVERT ASCII CHARACTER USING TABLE.
TABLE LXI H,TBL ESTABLISH POINTER
ADD L OFFSET POINTER BY ASCII
JNC COK NO CARRY AFTER ADD
INR H WAS CARRY AFTER ADD
MOV L,A COMPLETE TABLE ADDRESS
MOV A,M GET BAUDOT CHRTR
RRC IF SPECIAL CHARACTER
CC LEFT PRINT LEFT PARENTHESIS
CALL CC0 IF NOT A SPECIAL CHRTR
ANI 400 EXIT
JZ DONE SPECIAL CHRTR REQUIRES
CALL H RIGHT PARENTHESIS
POP P RESTORE HL AND AF
DONE POP P
RET

136.000 315 117 040
136.003 323 071
136.005 076 100
136.007 323 071
136.011 076 116
136.013 323 071
136.015 076 005
136.017 323 071
136.021 076 037
136.023 062 153
136.026 311

136.027 365
136.030 345
136.031 315 111 040

136.034 041 154 136
136.037 205
136.040 322 044 136
136.043 044
136.044 157
136.045 176
136.046 017
136.047 334
136.052 315 122 136
136.055 346 040 136
136.057 312 065 136
136.062 315 132 136
136.065 341
136.066 361
136.067 311

```

Program A. Assembly listing.

136.070	017			(X) CASE AND CHARACTER	OUT TO PRINTER.
136.071	365			CCO	RRC START CASE CHECK
136.072	076	303			PUSH PSW SAVE SHIFTED CHARACTER
136.074	077				MVI A,3030 SYNTHESIZE CASE
136.075	027				CMC INVERT CARRY
136.076	027				RAL AND SHIFT LEFT
136.077	027				RAL AGAIN
136.100	041	153	136		RAL ONCE MORE
136.103	276				LXI H,CASE POINT TO CASE
136.104	312	115	136		CMP M IS IT SAME AS BEFORE?
136.107	062	153	136		JZ CASOK YES, SO EXIT
136.112	315	140	136		STA CASE NO, SO FIX MEMORY
136.115	361				CALL CHOUT AND SEND IT TO PRINTER
136.116	315	140	136	CASOK	POP PSW RESTORE AF
136.121	311				CALL CHOUT AND PRINT CHARACTER
					RET

(X) SEND LEFT PARENTHESIS.

136.122	365			LFT	PUSH PSW SAVE AF
136.123	076	037			MVI A,370 LEFT PARENTHESIS
136.125	315	070	136		CALL CCO PRINT SAME
136.130	361				POP PSW RESTORE AF
136.131	311				RET

(X) SEND RIGHT PARENTHESIS.

136.132	076	045		RGT	MVI A,450 RIGHT PARENTHESIS
136.134	315	070	136		CALL CCO PRINT SAME
136.137	311				RET

(X) SEND CHARACTER TO PRINTER AFTER
(X) CHECKING STATUS.

136.140	365			CHOUT	PUSH PSW SAVE AF
136.141	333	071		STAT	IN TTY(P)1 GET STATUS
136.143	017				RRC IS USART READY?
136.144	322	141	136		JNC STAT IF NOT, WAIT
136.147	361				POP PSW RESTORE AF
136.150	323	070			OUT TTY PRINT CHARACTER
136.152	311				RET

136.153				CASE	DS 1 LTRS/FIGS STATUS MEMORY
---------	--	--	--	------	------------------------------

(X) BIT 0, IF 1, YIELDS LEFT PARENTHESIS
(X) BIT 1, IF 1, YIELDS UPPER CASE (FIGS)
(X) BITS 2 - 6 ARE BAUDOT CHARACTER
(X) BIT 7, IF 1, YIELDS RIGHT PARENTHESIS

136.154	000			TBL	DB 00 BLANK
136.155	020				DB 200
136.156	020				DB 200
136.157	020				DB 200
136.160	020				DB 200
136.161	020				DB 200
136.162	020				DB 200
136.163	026				DB 260 BELL
136.164	164				DB 1640 BS (PRINTS 'X')
136.165	020				DB 200
136.166	010				DB 100 LINE FEED
136.167	020				DB 200
136.170	020				DB 200
136.171	040				DB 400 CARRIAGE RETURN
136.172	020				DB 200
136.173	020				DB 200
136.174	020				DB 200
136.175	020				DB 200
136.176	020				DB 200
136.177	020				DB 200
136.200	020				DB 200
136.201	020				DB 200
136.202	020				DB 200
136.203	020				DB 200
136.204	020				DB 200

136.205	020	DB	200	
136.206	020	DB	200	
136.207	020	DB	200	
136.210	020	DB	200	
136.211	020	DB	200	
136.212	020	DB	200	
136.213	020	DB	200	
136.214	020	DB	200	SPACE
136.215	066	DB	660	I
136.216	106	DB	1060	"
136.217	122	DB	1220	#, OR USE 3210 (H)
136.220	046	DB	460	%, OR USE 2450 (D)
136.221	271	DB	2710	PERCENT (C)
136.222	152	DB	1520	^, OR USE 3610 (M)
136.223	056	DB	560	'
136.224	076	DB	760	(
136.225	112	DB	1120)
136.226	365	DB	3650	ASTERISK (X)
136.227	331	DB	3310	PLUS (P)
136.230	062	DB	620	,
136.231	016	DB	160	-
136.232	162	DB	1620	.
136.233	166	DB	1660	/
136.234	132	DB	1320	0
136.235	136	DB	1360	1
136.236	116	DB	1160	2
136.237	006	DB	60	3
136.240	052	DB	520	4
136.241	102	DB	1020	5
136.242	126	DB	1260	6
136.243	036	DB	360	7
136.244	032	DB	320	8
136.245	142	DB	1420	9
136.246	072	DB	720	:
136.247	172	DB	1720	;
136.250	311	DB	3110	LESS THAN (L)
136.251	205	DB	2050	EQUAL (E)
136.252	351	DB	3510	GREATER THAN (G)
136.253	146	DB	1460	?
136.254	215	DB	2150	AT (A)
136.255	014	DB	140	A
136.256	144	DB	1440	B
136.257	070	DB	700	C
136.260	044	DB	440	D
136.261	004	DB	40	E
136.262	064	DB	640	F
136.263	150	DB	1500	G
136.264	120	DB	1200	H
136.265	030	DB	300	I
136.266	054	DB	540	J
136.267	074	DB	740	K
136.270	110	DB	1100	L
136.271	160	DB	1600	M
136.272	060	DB	600	N
136.273	140	DB	1400	O
136.274	130	DB	1300	P
136.275	134	DB	1340	Q
136.276	050	DB	500	R
136.277	024	DB	240	S
136.300	100	DB	1000	T
136.301	034	DB	340	U
136.302	170	DB	1700	V
136.303	114	DB	1140	W
136.304	164	DB	1640	X
136.305	124	DB	1240	Y
136.306	104	DB	1040	Z
136.307	345	DB	3450	LEFT BRACKET (B)
136.310	251	DB	2510	REVERSE SLASH (R)
136.311	345	DB	3450	RIGHT BRACKET (B)
136.312	235	DB	2350	UP ARROW (U)
136.313	217	DB	2170	UNDERLINE (-)

136.314

END

START

and the program reassembled.

Lookup Table

The lookup table contains one data byte per ASCII character. Each byte contains the five-bit Baudot character to be printed plus three control bits. As shown in Fig. 3, the least significant bit in the byte is 1, if the character is one of the special Baudot characters that will be enclosed in parentheses. If the second bit in the byte is 1, the

Baudot character will be shifted to uppercase (FIGS). If the most significant bit in the byte is 1, a right parenthesis will be printed after the Baudot character. Several examples of typical characters are given in Fig. 3.

Minor keyboard variations from one printer to another may require you to alter your lookup table. Machines in common use include those having Telex, TWX, Weather, Military Standard and International Alpha-

Upper-Case	Telex	TWX	Military	International #2
B	?	5/8	?	?
C	:	WRU	:	:
D	WRU	\$	\$	WRU
F	\$	1/4	!	NA
H	#	NA	STOP	NA
J	BELL	,	,	BELL
K	(1/2	((
L)	3/4))
S	'	BELL	BELL	'
Z	"	"	"	+

Table 5. Differences in common Baudot character sets.

1. Load tape prepared using instructions from Table 3.
2. Note Stop Address.
3. Change contents of five memory locations using Table below.
4. Reenter Stop Address noted above.
5. Put new tape in record cassette machine.
6. Push "DUMP."
7. You now have a tape containing a program, the Editor, for example, which has a new High Memory point (to protect the ASCII/Baudot Driver), a new Pad, and five changes in the I/O Driver portion to provide jumps into the ASCII/Baudot Driver routines. Note that this has taken two load and dump procedures.

Memory Address	Was	Change To	Comments
040365A	1110	0270	ENTRY LO
040366A	0400	"BEGIN" HI*	ENTRY HI
041040A	3030	3150	CALL
041041A	1170	0000	INIT LO
041042A	0400	"BEGIN" HI*	INIT HI

*Use high byte of BEGIN EQU from Table 3. For example, if your H8 has 16K of RAM, you would use 1360 at memory locations 040366A and 041042A.

Table 4. Modifying Heath I/O driver.

bet #2 character sets. Stay away from Weather machines since their character set contains many inapplicable uppercase weather symbols. The differences in the remaining four character sets are summarized in Table 5.

The lookup table in this driver assumes that a Military Standard printer is used. The printer, a model 28KSR, has been modified to provide a # character for uppercase H. It is particularly easy to substitute characters in the type basket of the model 28. Other characters that may be substituted include a * for uppercase H, and a + for uppercase G. Remember that the lookup table must be modified to reflect any changes that you may wish to make.

CRT displays allow use of the back-space function (ASCII control H), while most printers do not. Since it is desirable to

tell when a back space has occurred, the character X is printed each time you back space. If, during an edit, you made a mistake and back spaced to correct it, the following would be printed:

MISTOKEXXXAKE

When listed a second time, the spelling would be correct.

All ASCII characters not covered by normal and special equivalents in the table will cause a space character to be printed. Note that lowercase alphabetic characters are not included in the table, although they can be easily added at the end of the table if necessary.

Acknowledgements

Thanks to Dr. Glyn Harding for his helpful suggestions on program structure, and to Irv Hoff for his suggestions pertaining to the lookup table. ■

 * 000 0 0 0 000 0 0000 *
 * 0 000 0 0 0 00 00 *
 * 0 000 0 0 0 00 00 *
 * 000 0 0 0000 000 0 0000 *
 * 00000 *
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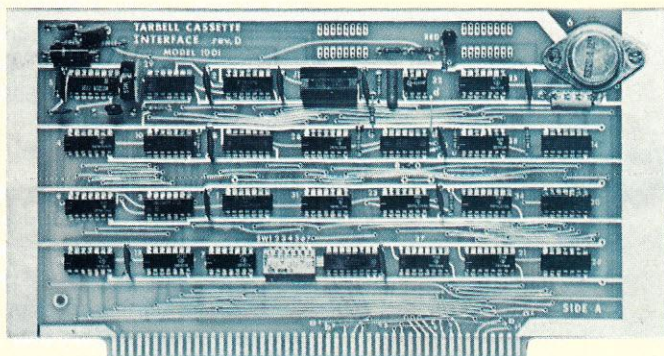
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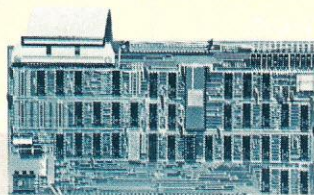


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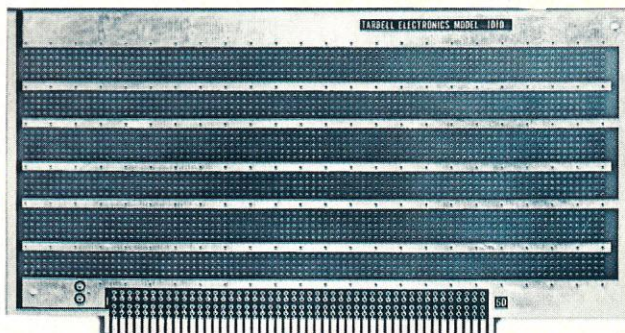


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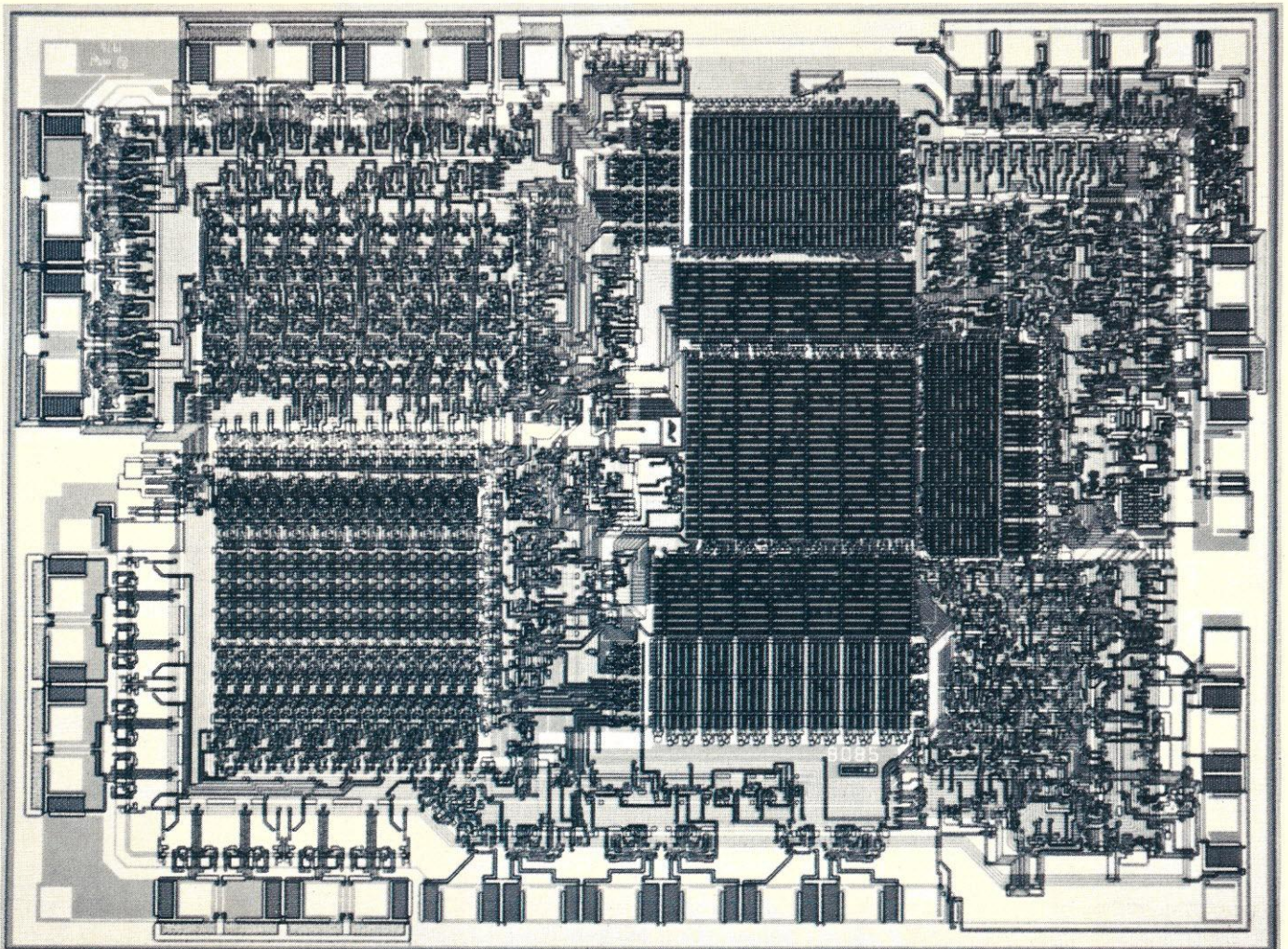
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8080, Z-80 or 8085?

A look into the relative merits of three Intel chips—you may find that you're happy right now.

The 8085 is Intel's latest entry into the eight-bit microprocessor market. As an enhanced version of the 8080, the 8085 forms the basis of a microcomputer system that is both simpler and more powerful than the 8080. The introduction of the 8085 has made the 8080 obsolete and provided



Photomicrograph of the 8085.

some strong competition for Zilog's Z-80.

Some History

Intel's 8080 microprocessor made the first hobbyist computer possible, and has since become the standard of the industry. Though numerous other processors have taken over a significant share of the market, there is still more hardware and software available for the 8080 than any other processor. In order to make it easier for people now using the 8080 to switch to a next-generation processor, Intel and Zilog have both introduced new processors that can use, without modification, most programs written for the 8080.

Zilog's Z-80 was the first processor to threaten the 8080's market dominance by including the entire 8080 instruction set as a subset of its own, much larger, instruction set. Therefore, most programs written for the 8080 will also run on the Z-80. In addition, the Z-80's sophisticated instruction set makes it attractive for software-intensive applications. Zilog also improved the 8080 hardware by providing on-chip clock generation, single supply operation, a faster clock rate and other features.

Now Intel has introduced a new processor, the 8085, which is also software compatible with the 8080. Intel has taken a different approach than Zilog, however, by making only negligible additions to the instruction set and placing emphasis on a simplified hardware system. Intel's goal was to simplify the entire system, including ROM and RAM.

With the 8085 system, it is possible, using only three ICs, to build a system with 256 bytes of RAM, 2K bytes of EPROM or ROM, 39 bits of I/O, a programmable timer and four vectored priority interrupts. No other microprocessor can provide this much capability with only three chips.

The 8085 System

The three ICs that make this powerful system possible are the 8085 processor, the 8155

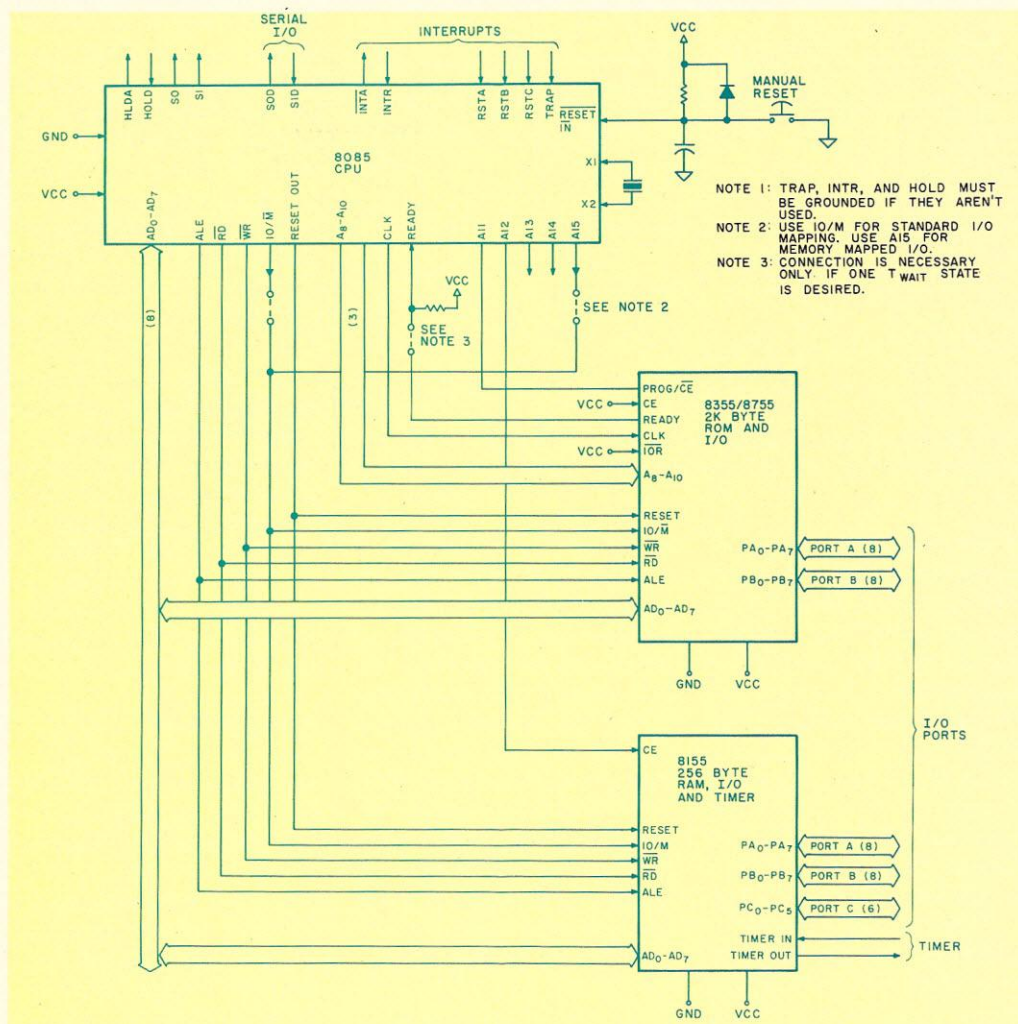


Fig. 1. 8085 minimum system. The three-chip system consists of the 8085 processor, the 8755 EPROM and I/O, and the 8155 RAM, I/O and timer. The system bus is similar to the 8080 except that the low-order byte of address and the data bus are multiplexed together.

RAM, timer and I/O, and the 8755 PROM and I/O. Fig. 1 shows the complete minimal system. All three ICs are contained in 40-pin packages, which allows the integration of other functions with the ROM and RAM chips. The system has two unique features: a multiplexed address/data bus

and two special chips that provide RAM, ROM, I/O and a timer.

Fig. 2 summarizes the main differences between the 8080, the 8085 and the Z-80. The 8085 does not require a clock generator or system controller chip, as does the 8080. It provides three vectored interrupts with-

out any external hardware. Other features include a single 5 V supply, serial I/O pins and a 3 MHz clock speed.

The 8085 CPU

The major architectural change in the 8085 is the use of a multiplexed address/data bus. The data and the lower half

	8080	8085	Z-80
On-chip clock generator	no	yes	yes*
On-chip status latch	no	yes	yes
Vectored, priority interrupts without external hardware	no	yes;three	no
Nonmaskable interrupt	no	yes	yes
Single 5 V supply	no	yes	yes
Serial Input/Output on-chip	no	yes	no
Clock speed	2 MHz	3 MHz	2.5 MHz
Special multifunction support chips	no	yes	no
Multiplexed bus	no	yes	no
Expanded instruction set	—	no	yes
Dynamic memory refresh	no	no	yes

*Oscillator required

Fig. 2. Comparison of the 8080, 8085 and Z-80.

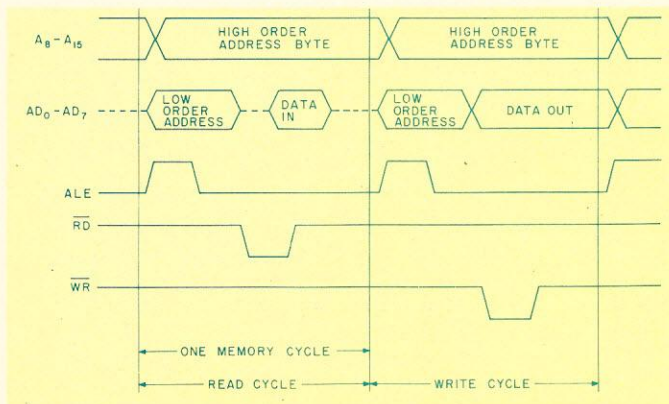


Fig. 3. 8085 system timing. The trailing edge of ALE signals the rest of the system that the address/data bus contains a new address.

of the address bus are multiplexed onto a single set of eight pins. At the beginning of each memory cycle, the low-order byte of address is placed on the address/data pins and a new control signal, Address Latch Enable (ALE), is generated to indicate that a new address is present on the address/data lines. ALE clocks this byte of address into a latch external to the processor. This latched address is then fed to the rest of the system, and the processor can free the address/data lines to carry data. The bus timing is shown in Fig. 3.

This multiplexed bus reduces by eight the number of address and data bus lines required. Only one new signal (ALE) is added to accomplish this, so the 8085 has seven more pins available for control signals. Two additional pins were freed by the elimination of the +12 V and -5 V supplies. These nine free pins make possible many of the 8085's new features.

The 8085 has four new interrupts that give it a simple and powerful interrupt structure—three priority interrupts, and one unmaskable (top priority) interrupt. Each is controlled directly by a single pin on the 8085; no other hardware is required to make the interrupts priority or mask them, or to insert an instruction on the data bus, as is required with the 8080.

The pins are called TRAP (nonmaskable) and RST 5.5, RST 6.5 and RST 7.5. Fig. 4 shows the 8085's interrupts

and their jump addresses. A high level on the RST 5.5 pin, for example, will cause a jump to address 002C, provided that interrupt has been enabled.

In order to allow these interrupts to be individually masked, two new instructions were added. Set Interrupt Mask (SIM) selectively disables the interrupts. Read Interrupt Mask (RIM) allows you to read the status of the interrupts. These two instructions are the only additions to the 8080 instruction set.

The 8085 has pins for serial I/O to provide one input bit and one output bit without any peripheral hardware. The RIM and SIM instructions are also used to read and set the serial I/O pins.

The 8085 provides all of the control signals directly at its pins. With the 8080, an 8228 is required to latch the control signals off the data bus, on which they were multiplexed.

The 8085 control bus is also organized differently. The main control signals are \overline{RD} , \overline{WR} and $\overline{IO/M}$. $\overline{IO/M}$ indicates whether the instruction is addressing an I/O port or memory. This saves one control line as compared to \overline{MEMRD} , \overline{MEMWR} , \overline{IOR} and \overline{IOWR} in the 8080. Both sets of signals contain the same information, and one can be generated from the other using a few gates.

The 8085 has pins for Reset In, Reset Out, Ready, HOLD, HLDA, INTR and \overline{INTA} , which function identically to those on the 8080. There are two new status lines (S1 and S0), which

indicate whether the current cycle is an op-code fetch, a read or a write, or if the processor has been halted by a HALT instruction. The read and write status information is not used to control bus transfers, but provides advanced timing information on the type of machine cycle in progress. In most systems this information is not used.

The 8085's final hardware simplification is the addition of a complete clock generator on the CPU chip. The only required clock components are a crystal or a resistor and capacitor. This incorporates the functions of the 8224 within the 8085, and completes the transition from the three-chip CPU of the 8080 to the 8085, a true one-chip CPU.

Processor Speed

As an additional performance improvement, the 8085's instruction execution rate is about 50 percent greater than the 8080's. The basic clock frequency is 3 MHz, as opposed to the 8080's 2 MHz. (The recently released 8085A-2 runs at 5 MHz!) In addition, there is a subtle increase in speed by clever handling of conditional jumps. The 8085 fetches the second byte of the instruction (the first byte of the jump address) while it is deciding if the jump condition is satisfied, and

then skips the last byte of the instruction (the second byte of the address) if it doesn't need to make the jump. The 8080 always fetches all three bytes of the instruction and wastes a machine cycle if the jump condition is not satisfied. Thus, the 8085 executes an unsatisfied conditional jump in approximately 30 percent fewer clock cycles than the 8080.

There are two new versions of the 8085 now available. The 8085 is being replaced by the 8085A, which is identical in most respects. The new A version differs only in the state of certain control signals during specific conditions, which are

Interrupt	Jump Address (HEX)
RST 0	0000
RST 1	0008
RST 2	0010
RST 3	0018
RST 4	0020
*TRAP	0024
RST 5	0028
*RST 5.5	002C
RST 6	0030
*RST 6.5	0034
RST 7	0038
*RST 7.5	003C

Fig. 4. 8085 interrupts. The interrupts marked with * are new to the 8085, and each has its own interrupt request pin. The others are the same as the 8080 interrupts and are initiated using INTR and \overline{INTA} .

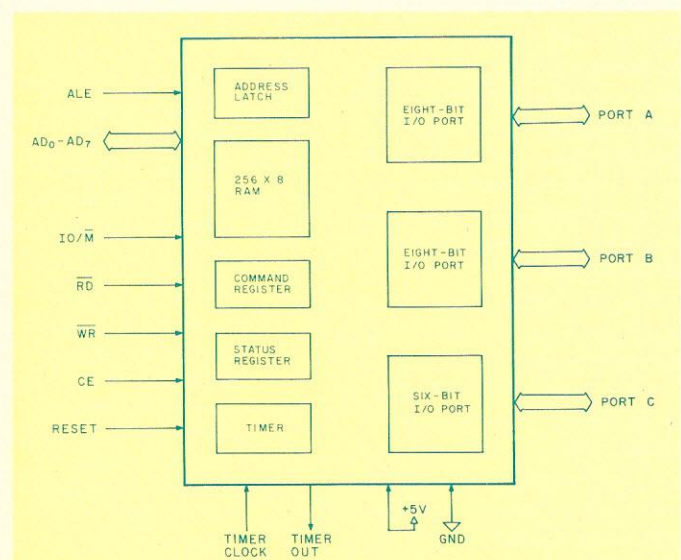


Fig. 5. 8155 RAM, timer and I/O. Each of the three ports may be selected as input or output. Additionally, port C may be selected as a control/status port. The selection of port modes, as well as the control of the timer, is performed by writing the appropriate control word to the command register.

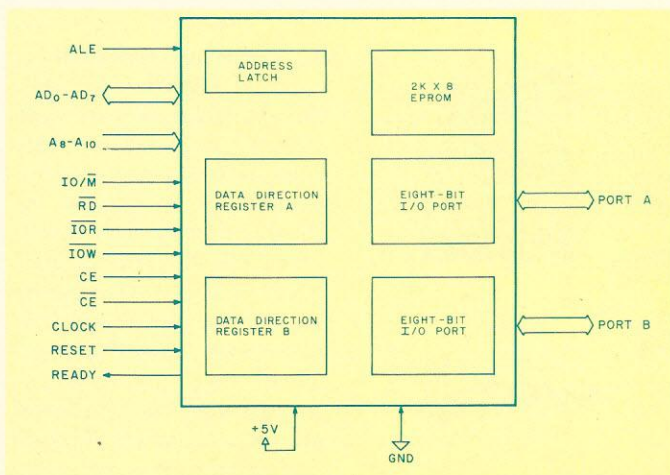


Fig. 6. 8755 EPROM and I/O. Each bit of the I/O ports may be individually selected as input or output via the two data direction registers. The 8355 is an identical part except that it contains a mask-programmed ROM.

"don't cares" for most users. The changes will make the 8085A easier to use in some large systems. The new 8085A-2 is the fastest general-purpose, eight-bit processor now available.

The 8085 Memory and Interface Chips

As shown in the previous section, the 8085 added many hardware features at the price of the added complexity of a multiplexed address/data bus. The penalty is not too high, however, since the bus can be de-multiplexed with a single eight-bit latch. And, in fact, Intel has turned the multiplexed bus into a valuable feature by providing memory and peripheral chips with the address de-multiplexing latch on the chip. Thus, the chips have only eight address/data pins and an ALE pin, instead of eight data and eight address pins. This saves seven pins on each chip, as well as seven bus lines.

The 8155 chip contains a 256-byte static RAM, two eight-bit I/O ports, a six-bit I/O port and a 14-bit programmable counter/timer. The block diagram is shown in Fig. 5. A command register in the 8155 determines the function of the ports and controls the timer. The two eight-bit I/O ports may each be specified as input or output ports. The six-bit port may operate as an input, output or control port. In the control-port

mode, it provides a strobe input for either of the eight-bit ports to be used as latched input ports. It also provides a buffer full signal for each of the ports, indicating that the port contains new data that has not yet been read.

The 8155 also contains a 14-bit programmable timer. It has several modes of operation, but, basically, it will count a specified number of clock pulses and then generate an output pulse. The clock may be the system clock or any other signal. Both the mode and the number of counts are under software control via a command register, and the timer's status may be read from a status register on the chip.

The third chip in the system is the 8755, which contains a 2K X 8 EPROM and two eight-bit I/O ports. The block diagram appears in Fig. 6. The EPROM is similar to a 2716; the two I/O ports are unique in that each line may be individually specified as input or output. Thus, you may have five input bits and eleven output bits, for example. The mode of each pin is set by software, via two data direction registers on the chip.

The 8355 is identical to the 8755, except that it contains a mask-programmed ROM. For applications where the same program is to be reproduced in considerable volume, the 8355 provides a cost-effective

alternative to the 8755.

Applying the 8085

The 8085 is a very easy micro-processor to use. Using the basic three-chip system already discussed, the only additional components required to make a complete microcomputer system are a crystal and power-up reset circuitry. Peripherals are, of course, required, but they are independent of the particular processor being used.

Standard memory and peripheral chips may also be used with the 8085, but the address/data bus must be de-multiplexed. Fig. 7 shows the address latch to perform this function, in addition to the gating to generate 8080-type control signals. ALE strobes the address into the latch (see timing diagram in Fig. 4). The latched outputs drive the lower half of the address bus. The data bus actually contains address information early in each memory cycle. This doesn't cause any problems because neither \overline{RD} nor \overline{WR} will be true at this time, and all parts of the system should be ignoring the data bus. Once the bus has been de-multiplexed, any of the 8080 family components may be easily interfaced.

The control signal gating shown is straightforward. In practice, it will usually not be necessary to use actual gates. If the memory chips have more

than one chip enable input (many do), one can be used for $\overline{IO/\overline{M}}$ and another for \overline{RD} or \overline{WR} (for RAMs) or just \overline{RD} (for ROMs). When the 8155, 8355 or 8755 are used, no gating of any kind is needed; it is incorporated into the memory chip.

An interesting side note is that the signals have been arranged on the pins of the three chips to facilitate simple and dense PC layouts. A complete system consisting of the three chips, crystal, pull-up resistor for the Ready line, and resistor, capacitor, and diode for power-up reset, fits on a circuit board measuring 3 1/4 x 4 5/8 inches. The layout for this board is provided in Intel's *8085 Microcomputer Systems User's Manual*.

Current Products

There are currently at least two 8085-based products suitable for personal-computing applications. Intel produces the SDK-85, which is a single-board computer complete with keyboard (hexadecimal and control) and a six-digit display. An 8355 ROM chip contains a monitor program to allow entering of programs, viewing the contents of memory and numerous other features. An 8155 provides 256 bytes of RAM. All of the I/O lines are available, and a large wire-wrap area is provided for expansion. A complete kit (less power supply) is available from any of Intel's dis-

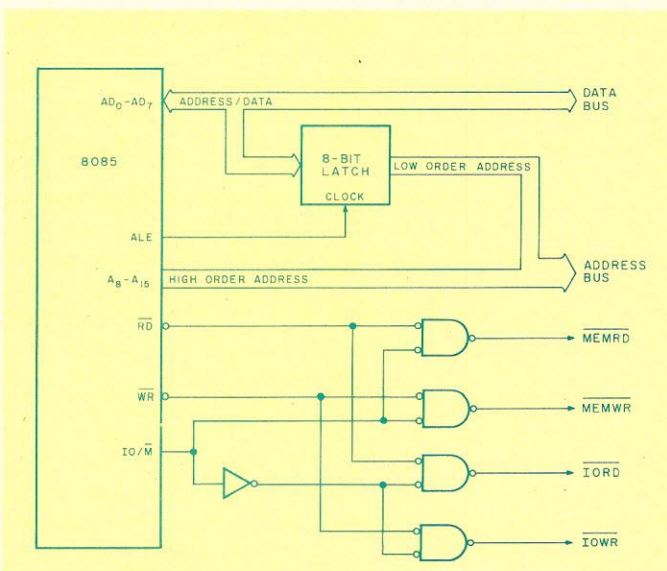


Fig. 7. Interfacing the 8085 to an 8080-type bus. The latch de-multiplexes the address/data bus, and the gates generate the usual bus control signals.

tributors for 250 dollars.

The other product is the SPACE BYTE 8085 CPU. It is an S-100-compatible CPU board utilizing the 8085 and 8155, with three 2708s, instead of the 8755. The PROMs contain a system monitor. Two RS-232C serial ports, along with parallel I/O, are provided. The bus is demultiplexed, and S-100-compatible control signals are generated. It is available from the Space Byte Corporation (and computer stores) for \$499.

The 8085 vs the Z-80

Since the Z-80 and the 8085 are the only 8080-compatible processors now available, many users will be faced with the task of selecting one of the two. One thing is clear: There is no longer any reason to design a system using an 8080.

From a software viewpoint, the Z-80 is superior. It has a greatly expanded instruction set, and double the number of registers. There is some question, however, as to the value of this increased software power.

If you program in BASIC or other high-level languages, the Z-80's extra instructions will make no difference to you. If you have an interpreter optimized for the Z-80, your BASIC might run faster than on an 8085. The difference is likely to be insignificant to most users.

One of the Z-80's features is special instructions for block move and block search. These instructions are useful when blocks of data are being processed. It must not be assumed, however, that these instructions speed up block-oriented tasks. In fact, block-move and block-search subroutines for the 8085 may run faster than the single instructions on the Z-80! The 4 MHz Z-80A is faster than the 8085 subroutines, but the difference is not likely to be significant. You would have to write and store these subroutines, however, and that is the advantage of the Z-80's built-in instructions.

In the realm of hardware, both processors have their advantages. The 8085's new interrupts are much easier to use

than any of those available on the Z-80. The scheme is less flexible than the Z-80's, but is more than adequate for the vast majority of applications and requires no external hardware. For those few applications that really do require a sophisticated interrupt structure, Intel's 8259 interrupt controller chip provides this capability. Another ease-of-use factor is the 8085's on-chip oscillator. The Z-80 requires an external clock oscillator, while the 8085 requires only a crystal.

A big advantage of the 8085 is the available support chips. A much simpler and more powerful minimal system is possible with the 8155 and 8755, as compared with the Z-80 system. Because of the multiplexed address/data bus, it would not be easy to use these chips with the Z-80 (or any other processor).

The power of the 8085 system is most apparent in dedicated controller systems, where 256 bytes of RAM and 2K bytes of ROM are adequate. The 39 I/O lines provided by the three-chip system are enough for most applications. For applications requiring more memory, only one chip (an eight-bit latch such as the 8212) is required to interface to standard memories. The inclusion of the 8155, though contributing a relatively small amount of RAM, provides a counter/timer and 22 flexible I/O lines with some associated control logic.

The Z-80 also has its advantages, but they are relatively

minor. It does not multiplex any pins, which saves one chip when interfacing to standard memories. This is offset, however, by the lack of an on-chip clock oscillator.

A much-acclaimed Z-80 feature is the dynamic memory refresh incorporated into the CPU. It is not, however, without its problems. The refresh address is output during each opcode fetch cycle. Therefore, the refresh rate is directly tied to the instruction execution rate, which may have serious consequences. If the processor is single-stepped, either by slowing the clock or by using the Ready line, the refresh will no longer work. Reset will also halt the refresh, so if a manual reset push button is incorporated in the system, some form of one-shot must be used to protect the memory from being wiped out by the reset button. Finally, a lengthy DMA operation may precipitate loss of the memory contents.

A couple of other points about refresh are worth mentioning. The vast majority of systems use either static memories (where refresh is not needed) or dynamic memory cards with built-in refresh circuitry. Another consideration is that the Z-80 will usually refresh the memory at a much faster rate than necessary, resulting in a higher power consumption for the memory.

The choice of an 8085 or a Z-80 ultimately must depend upon the application. In a dedicated controller type of appli-

cation where the 8085 three-chip system provides adequate resources, the 8085 is definitely the best choice. In a software-intensive application where much assembly-language programming is anticipated, the Z-80 would probably be a better choice. For the myriad of applications that fall between these two extremes, the advantages and disadvantages of each processor must be carefully weighed. If the decision seems difficult, perhaps you can take comfort that either processor would probably do the job well.

Future Products

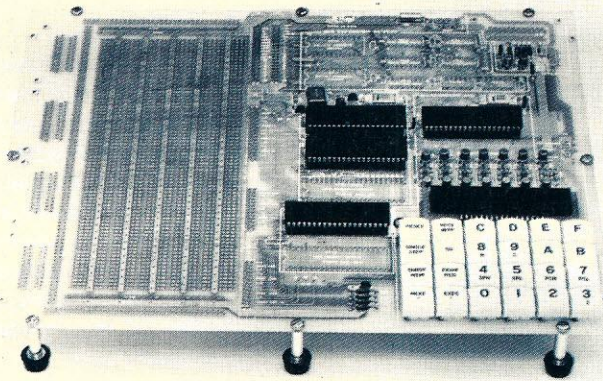
As may be expected, the battle between Intel and Zilog will not stop here. As Zilog is planning the Z-8 and Z-8000, Intel is working on the 8086 and 8088. The 8086 will be a high-speed (8 MHz clock) 16-bit processor to be introduced early in 1978. It has been reported that the 8088, to be released some time later, will be a 16-bit processor internally, but will use an eight-bit external data bus. Eventually, the 8088 may replace the 8085 in many applications. These next-generation processors will retain basic software compatibility with the 8085 (via assembly-language translation programs) and will also have a similar bus structure.

The 8085 may never have the popularity enjoyed by its predecessor, but its impact on the market will definitely be felt. It is especially cost effective in dedicated controller applications, but it is worth close examination by anyone designing a new system. ■

References

1. *8085 Microcomputer Systems User's Manual*, Intel Corporation, Publication no. 98-366B, \$5.
2. *8080/8085 Assembly-Language Programming Manual*, Intel Corporation, Publication no. 9800301B, \$5.
3. *An Introduction to Microcomputers*, Osborne and Associates, Vol. II, 2nd edition.

Intel publications are available from: The Intel Corporation, 3065 Bowers Ave., Santa Clara CA 95051.



Intel's SDK-85 design kit.

Edward Copes
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West Chester PA 19380

One Keyboard: Hex and ASCII

Here's a simple converter circuit that allows a single keyboard to function two ways.

Recently, when I upgraded my home-brew 1802-based system from a hex keyboard to a full ASCII keyboard, I was confronted with a problem. Once the operating system was loaded, the system could take the ASCII data and convert it to hexadecimal machine-language instructions via software. But to load the operating system I still needed a keyboard that produced hex

directly.

Inserting this simple two-chip circuit between the ASCII keyboard and the input port solved the problem. The circuit takes ASCII data from the keyboard and converts the characters 0-9, A-F to their proper four-bit hex format. Now my one ASCII keyboard can function either as an ASCII or hex keyboard, depending on system requirements. ■

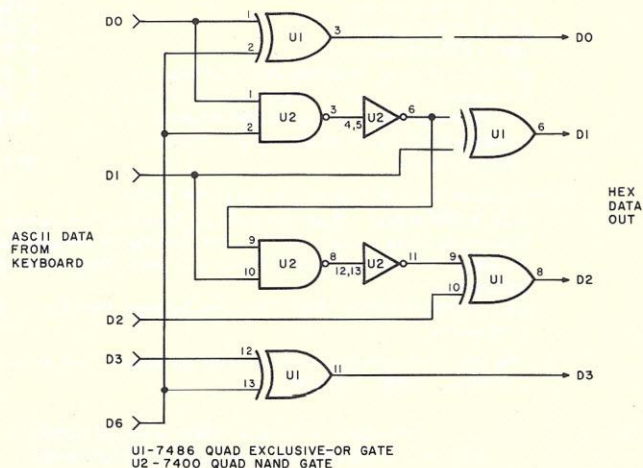


Fig.1. ASCII-to-hex data converter.

the Computer Store

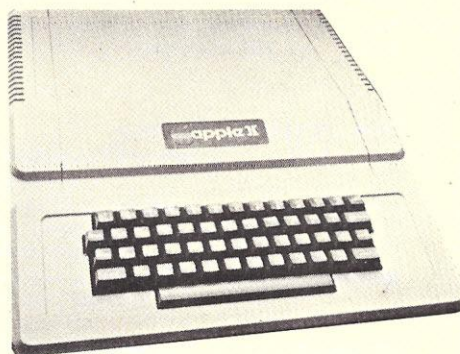
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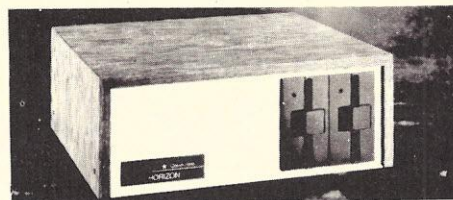
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Is the Malibu Model 160 the Printer for Your Business System?

At \$200, this may not be a popular hobby printer, but for business, where a 132-column printer is a must, it's most interesting.

One of the most important pieces of peripheral equipment for any business system is the printer. During my search for a suitable printer for my system, I was confronted with trade-offs and considerations, but two items remained at the top of the list—dependable operation and speed. I feel that I've obtained both through the purchase of a Malibu printer and would like to share with you some of the fine points,

and a few shortcomings, of the unit.

I am neither a technician nor an engineer; I am a businessman. Even though I had some technical assistance in the preparation of this article, the bulk of the comments here reflect my feelings on how the unit contributes toward making my system the useful tool it is. John Craig suggested that I direct my remarks to other businessmen who might also be

shopping for a hard-copy device.

General Overview

As mentioned earlier, dependable operation and speed were two of the main considerations, but the added bonuses of quiet operation and styling were also realized with the Malibu unit. Photo 1 shows the styling, which, quite frankly, played a part in my decision (moving that teak cabinet into my office

was almost like adding a fine piece of furniture). The clear plastic cover over the print mechanism, which almost completely seals the entire unit, contributes greatly toward noise reduction. There is, of course, a slot for the paper to come out of the top and enter from the bottom, but the noise escaping from these two openings is minimal and not objectionable. I am sure the sound-proofing within the cabinet contributes a lot toward this end.

I've been using my disk-based Imsai system for almost a year now and there have been several instances when I've had to go through the trauma of adding (interfacing) additional devices that hardly ever worked—at first, anyway—even though the additions were installed by experienced technicians from the store where I bought my system. Adding the hardware components of this printer to my system went smoothly. The entire operation took no more than 15 minutes and simply involved removing the cover from the computer, plugging in the S-100 interface board, running a cable over to the printer, plugging it in and turning everything on! (More on the software interface later.)

Prior to the Malibu printer, I had been operating with an ASR-33 Teletype. The difference in speed, print quality and noise level between the two is so vast that I'm only mentioning the Teletype as an after-

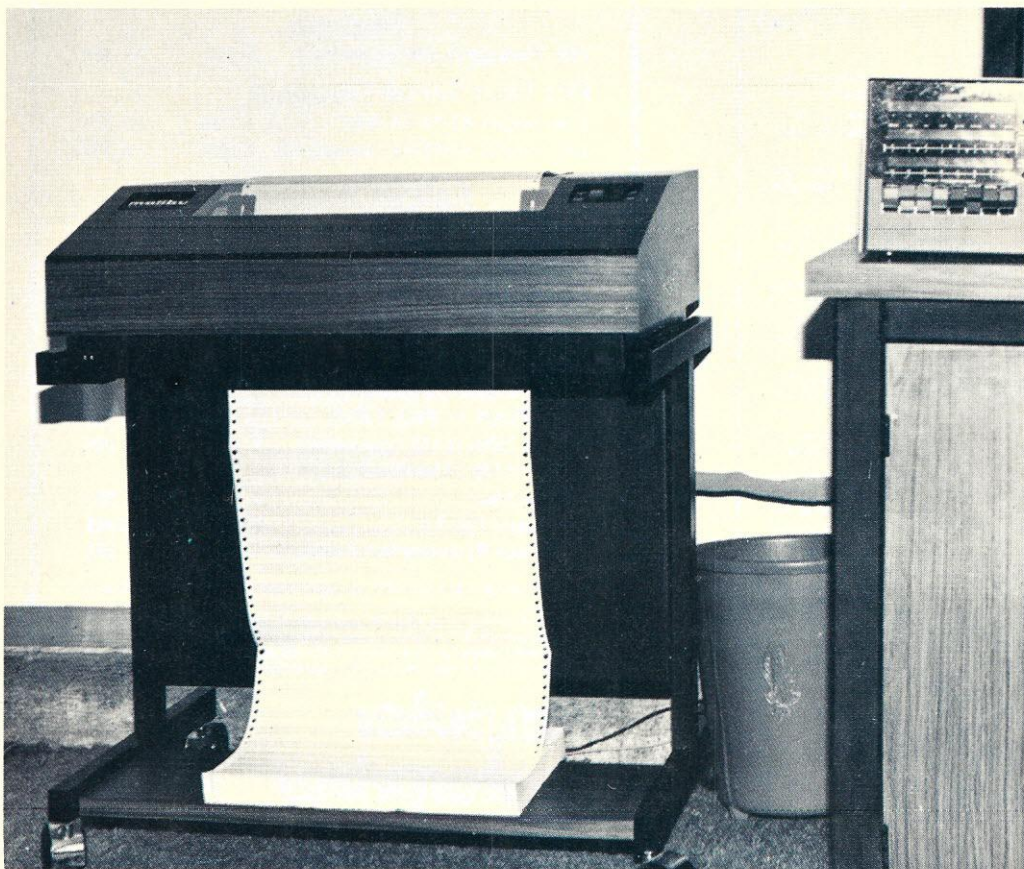


Photo 1. The Malibu Design Group Model 160 Printer: a good-looking unit.



Photo 2. Different-sized paper and forms. A big plus for the Malibu.

thought. Comparing the dependability of the two is difficult at this time since I've only been operating the Malibu for a few weeks. Due to the small number of moving parts, I'm confident the Malibu will come out shining in this area.

Printing is done at an incredible 165 characters per second! (Memories of the Teletype surely fan my enthusiasm on this point.) Much of the speed results from the unique combination of hardware and software which allows printing in both directions and determines the shortest distance the printhead has to go to begin printing. This feature is called bidirectional printing.

For example, if a line of 120 characters has just finished printing, and the next line to be printed is 80 characters long, a line feed will be initiated and the 80-character line will be printed backwards—while the printhead returns to the leftmost (home) position. In many other printers a line feed and head return will take place before the second line is printed—resulting in a lot of wasted time.

The print quality and character set were two important considerations in my choice of the Malibu. Several of the printers I looked over during the shopping stage produced very light printouts in comparison. One of the reasons the Malibu provides such dark, high-contrast printing is due to the self-inking ribbon used. Another factor is the Hydra printhead (more on that later).

One of the features I disliked most on other printers I looked at was the absence of descenders (the "tails" of certain lowercase letters actually *descending*). The Malibu character set provides for these descenders—as all the others should. Fig. 1 is a sample printout.

I'm not particularly thrilled that the unit is a dot matrix, rather than impact printer, but my wallet is happier that I didn't go with the latter.

I've asked several of my customers what they think of the new invoices they have been getting. Generally, the response is that, though they prefer not to get invoices at all, the new ones are quite an improvement over the old (gen-

erated by the Teletype). When I press them for an opinion on the actual characters—and how they are generated (with dots)—the usual response is, "Gosh, I hadn't noticed." So much for the shortcomings of dot-matrix print.

Miscellaneous Considerations

I dislike reading equipment reports that contain numerous dry specifications. But there are several features of this printer that really should be

mentioned.

The maximum line length is 132 characters, one of the considerations that made me decide on the printer. Several low-cost printers provide 72-character width, but I find that some monthly and quarterly reports practically demand the wider paper. Invoices are prepared on 8½ × 11-inch paper, and the mailing labels I generate for customer mailings are approximately 4½ inches wide. The variable width tractors are a

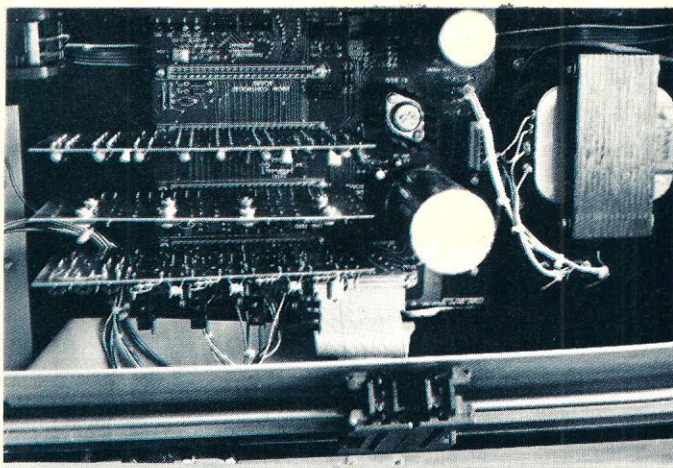


Photo 3. Inside the Malibu, the three main printed-circuit boards.

```

/0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz\ ]^_`abcdefghijklmnopqrstuvwxyz~! " # $ % & ' ( ) * + , - . /
/0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz\ ]^_`abcdefghijklmnopqrstuvwxyz~! " # $ % & ' ( ) * + , - . /
0123456789:;<=>?@ABCDEFGHIJKLMNopqrstuvwxyz\ ]^_`abcdefghijklmnopqrstuvwxyz~! " # $ % & ' ( ) * + , - . /
! " # $ % & ' ( ) * + , - . /0123456789:;<=>?@ABCDEFGHIJKLMNop
abcdefghijklmnopqrstuvwxyz~! " # $ % & ' ( ) * + , - . /01
BCDEFGHIJKLMNopqrstuvwxyz\ ]^_`abcdefghijklmnopqrstuvwxyz~! " # $ % & ' ( ) * + , - . /01

```

Fig. 1. Sample printout showing normal and expanded characters. Also note the lowercase characters with descenders.

definite asset. Photo 2 illustrates this capability.

Although I intend to have my computer serviced at a local store, it seems that I could almost make the repairs myself. That is, if I weren't afraid to take the cover off the unit and dig inside, and if I had spare printed-circuit boards.

There are only three boards in the printer to control all the operations (see Photo 3). The first is the logic card that interfaces with the software. (Incidentally, all of the character generation is done in software; therefore, the character set can be easily changed.) The second board controls the motor that feeds the paper and also controls the movement of the printhead. (Software makes the decisions regarding the direction it should take for the fastest print time.) The third board drives the solenoids on the printhead.

There is a fourth interface board, which contains a Z-80 microprocessor. This board is used for connecting the printer to systems other than the S-100 type and provides for two types of interfacing—RS-232 or 8-bit parallel (at speeds from 110 to 9600 baud). My Imsai, quite naturally, uses the S-100 interface board. This board contains the programs, in programable read-only memory (PROM), for generating the particular characters, handling the line of characters and telling the paper-feed motor when and

how far to advance.

A thumb-wheel switch in the lower left-hand corner of the printer allows the operator to select the number of spaces the paper will be advanced every time there is a FORM FEED command. This is a command from the computer which tells the printer to advance to the next form (e.g., the next invoice to be printed). The switch provides for settings from 1 line to 99 lines.

Photo 4 shows the manual paper-control switches on the cover of the unit. When the FORM FEED switch in the lower right-hand corner is depressed, the paper is advanced to the next page (the number of spaces is determined by the thumb-wheel switches).

Using this feature, the paper can be positioned to a spot called "top-of-form" so that printing will begin in the same position for each page. The LINE FEED switch will cause the paper to be advanced one space for each depression. The other two switches provide for incremental up or down positioning of the paper. No big knobs to turn—just push a button.

There is a particular feature about the ribbon which, although it is small, reflects the thoughtfulness that went into the overall design of this printer. The ribbon is set up to traverse from one side to the other *at an angle*. The result is that the printhead is continual-

ly using all of the ribbon, rather than just the top or bottom. Since ribbons are such a mess to change, I'm relieved that this

feature will surely extend the life of the ribbon.

The Hydra printhead, shown in Photo 5, is, I've been told, one

Glossary

8-bit parallel interface: Transferring data from the computer to a device one character at a time, rather than sending each bit of the character at a slower serial rate.

Bidirectional: The ability of a printer to print characters while the printhead is traveling from left to right or from right to left.

Baud: A data transmission term related to the number of bits (Binary digITS) transmitted in a second.

Character set: The complement, list or table of characters a printer is capable of printing. (With a different PROM the Malibu is capable of generating foreign-language character sets or other specialized applications.)

Descenders: The "tail" on certain letters, such as the j, y, p, g and q.

Dot matrix: The generation of characters by a matrix of dots. Following is an example of how a capital A is generated using a 5 × 7 matrix:

```

      x
    x x
  x x
xxxxx
  x x
  x x
  x x

```

Each x represents a dot made by the printhead. Due to the close spacing of the dots, the letters seem to run together into continuous lines.

Head return: The action of the printhead being returned to the home position (i.e., at the extreme left, where each new line begins). The same as a carriage return on a typewriter.

Impact printer: A printer that prints characters in the same manner as a typewriter.

Interface: The interconnecting of two devices (e.g., the computer and the printer) so they can work together as part of a system.

Line feed: The action of advancing the paper to the next line to be printed.

Line length: The number of characters that can be printed on a line (132 with the Malibu).

Patching: Modifying the software with minor changes so that the operation of a particular device becomes an integral part of the system.

Printhead: An assembly containing seven solenoids activated by electrical impulses to produce the dots that generate the printer's characters.

PROM (programmable read-only memory): A memory element that cannot be modified and can only be read. (All of the mechanical movements and character generation functions are contained in PROM in the Malibu printer.)

Routines: Program segments that are not part of the main program.

RS-232: An interfacing standard between computers and other devices that dictates the voltage levels at which data may be transmitted.

S-100: The "standard 100" pin bus that originated with the MITS Altair 8800 computer and has found widespread use in most microcomputer systems today.

Thumb-wheel switch: A rotary-type switch providing for the selection of a digit from 0 to 9.

Tractors: The devices at each end of the paper that accept the perforated holes in the paper and use those holes for feeding the paper.

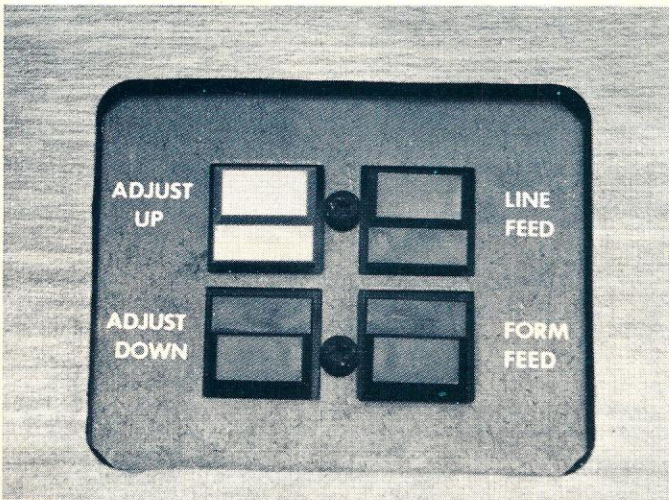


Photo 4. The manual paper-control switches.

of the most reliable and rugged available. Time will be the real test of this component, which is the heart of the printer, but so far I've been impressed with the quality of print it delivers and its rugged constitution. Since the entire unit radiates quality, I have no reason to doubt the claims made about the printhead.

Software Modifications

When you add a device such as this to your system there are actually two types of interfacing to contend with—the hardware and the software.

Making the printer work with my existing software involved modifying the programs with patches so the printout would be on the Malibu, rather than my Teletype. An experienced programmer took care of these modifications in a three-to-four-hour period. He explained to me that the task could have been very difficult if I did not have well-designed software.

Basically, the modifications involved changing the programs (making patches) so when printing is desired, control is transferred to the routines in PROM (provided by Malibu) on the interface board that

handle character generation, line handling and paper-feed functions.

Closing Thoughts

The primary use for this printer in my business (restaurant supply) is for generating monthly reports, customer billing, mailing labels and some accounts payable. It handles all of these jobs without a hitch. Because it is a dot matrix printer I'm not certain that it would be as satisfactory if my requirements included large quantities of textual material. However, I intend to try it with some customer bulletins in the future. For such applications, an uppercase and lowercase impact printer may be a better choice.

I don't normally sit down to write reports on products I have bought, but I was very impressed with this printer. I'm still fascinated with the speed of the unit and appreciate the quality of the print.

I enjoy the finer things in life; I drive a 27-year-old Cadillac, and the quality built into that car will very likely keep it on the road for another 27 years. I feel the same way about the quality built into the Malibu printer. ■

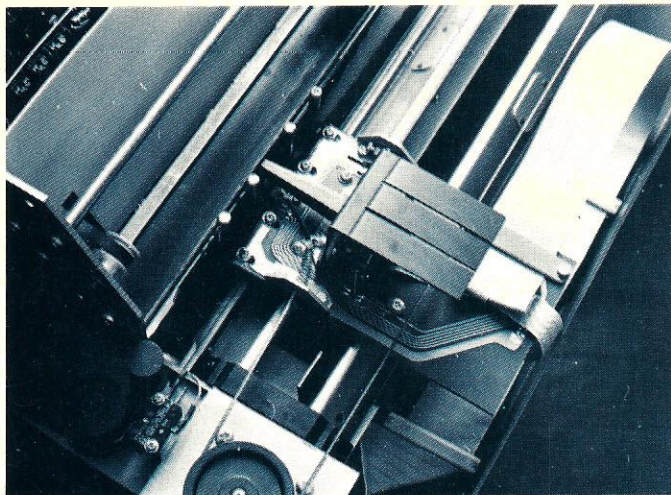
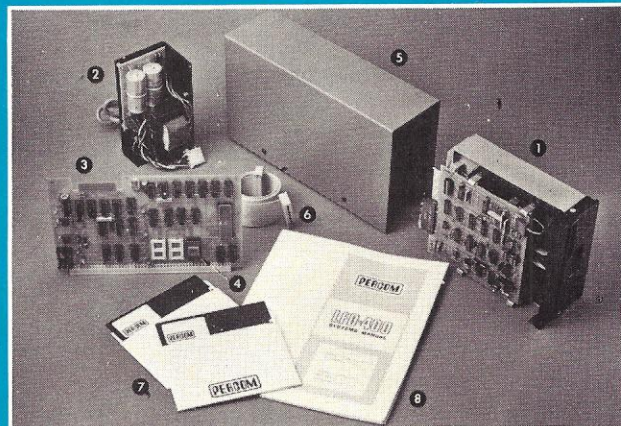


Photo 5. The heart of the printer: a high-reliability Hydra printhead.

The suggested list price for the Model 160 Line Printer is \$1995 (which is very close to \$2000). For further information, contact: Malibu Design Group, Inc., 21110 G Nordoff St., Chatsworth CA 91311, (213) 998-7694.

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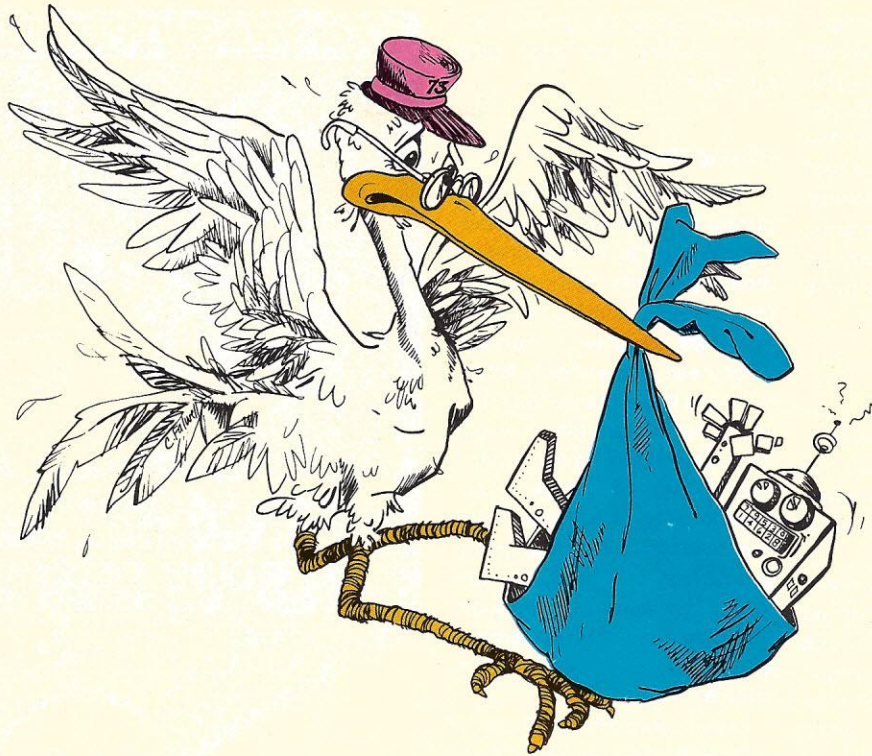
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P7



The Great Computer Conspiracy

You've heard that some people are afraid of computers? Maybe they have good reason to be.

Clint H. Woeltjen
La Habra CA

I guess it was bound to happen sooner or later with the office computer having access to billing as well as a telephone link to the lab computer, the new gigabyte memory and the new, unproven heuristic-algorithm operating system. We should have guessed that it was up to something when the auditor's computer started finding discrepancies in our records. No mere human could possibly

have circumvented the system.

It began one day last March. The computer ordered several hundred more TTL ICs than we actually needed for the project at hand. We could find no programming error, so assumed human error or a temporary hardware malfunction and waited for it to show up again. Meanwhile, the extra ICs never made it to the lab. A mobile manipulator (we call them robots for want of a better term) had been sent to ship-

ping and receiving to pick them up, but had returned empty handed. The plant is almost entirely automated, requiring only a few engineers and supervisory personnel.

The shipping-and-receiving administrator remembered seeing the package earlier, but didn't actually see the robot pick it up. Of course, you can't question one of our robots; they have only enough memory for the task at hand, so they can't be expected to remember previous jobs. Nor did we think of

questioning the computer; after all, a computer only does what it's programmed to do (anyway, what would a computer possibly want with a bunch of ICs?). We deduced that it was employee theft, but no one would admit to having done it. We beefed up our security system (controlled by the office computer), which caused employees' morale to drop, which caused their efficiency to drop, which caused us to fall behind on several key contracts, which caused us to

become overloaded with work, which caused us to discontinue the security system.

A week later, we received a receipt for a megabyte memory that no one could remember ordering, or paying for. We checked our records and found the order, but it hadn't been initialed properly, so we couldn't tell who had ordered it. Of course, things like that aren't supposed to happen. The office computer is supposed to check for proper initials before printing the check and mailing the order. As we were overworked at the time, however, no one noticed the computer's error. This time, we ran a thorough diagnostic program, but were unable to find the bug. We didn't realize then how easy it was for a sophisticated computer to lie, its own program supplying all of the proper responses while the diagnostic rested harmlessly in memory. As happened before, the megabyte of memory disappeared.

Then the circuit-board inspector got in trouble for not asking the computer to order additional circuit-board material. He claimed that there had been two extra boxes of pre-cut boards just yesterday; so we programmed a more extensive security program, including video input of the entire lab area. This time, we didn't let the employees in on the upgraded security plan, and to make sure that no one might let it slip, I did all of the programming myself. As usual, the entire system was controlled completely by the office computer. We used the office computer rather than the lab computer because the men in the lab didn't have access to the office computer and couldn't change the program if they found out. Of course, we didn't know that the office computer and the lab computer were friends and exchanged programs whenever they felt like it.

The next day, a considerable amount of microcomputer hardware was missing, including a video terminal, several UARTs and some obsolete Z-80 microprocessors. We checked the videotapes but found nothing; the camera set up to record that part of the lab had been unplugged and the videotape erased. The night watchman claimed that he hadn't seen anyone enter or leave the building all night, but after all, he's only human and can't be in two places at once.

We were beginning to suspect that the stolen material hadn't left the building. We also noted that all that was needed to build a complete microcomputer out of the stolen material was a power supply. I instructed the lab computer to build such a supply, and left it out on the lab bench before leaving for the night. That afternoon, I also removed the cameras and deleted the security program. I had the lab administrator punch out for me, but I stayed behind in the lab. I hid within view of the bench containing the power supply and waited.

Shortly after the last employee checked out, I saw one of the robots roll across the floor, remove the power supply and head toward the lab storage area. Meanwhile, another robot had moved some boxes and was removing a metal wall plate that was normally hidden by the relocated equipment. In our earlier search we had noted the panel, but had assumed that it was an electrical maintenance panel and ignored it. I watched as the first robot arrived with the power supply, installed it and turned it on. In the recess was a microcomputer, complete with a video terminal (which indicates to me at least that the robot didn't intend to keep it a secret forever), and on the display was printed the mnemonic "DAD DE."

I didn't have the heart to turn it off. ■

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C34



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Personal Computer Shows

A visitor to the San Jose show suggests that organizers and exhibitors bring showmanship and general appeal to future computer shows.

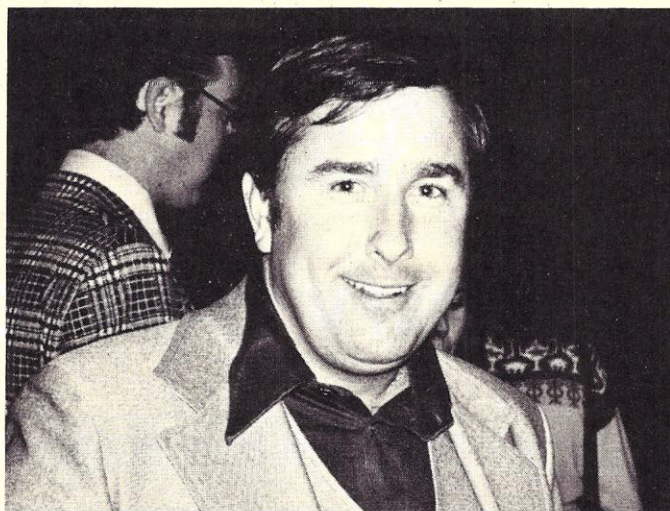
Paul J. Terrell
BYTE, Inc.
1261 Birchwood Dr.
Sunnyvale CA 94086

We're growing up as an industry. That was the undertone of the recently held second annual West Coast Computer Faire. Having been an observer and participant for the past two years at computer faires, shows, swap meets, etc., I noticed that something was obviously different in San Jose. The throngs of people were there, and I judged from conversations with manufacturers that the sales level of products was just as brisk, but something was different. But what?

Electricity... it was in the walls, feeding the computer displays, but it wasn't in the air. The excitement and anticipation of new products from major manufacturers was missing. Radio Shack, Heathkit, and Commodore had long since made their debut. IBM displayed the 1510 computer, but at \$18,000, no one was beating a path to their door.

Electricity is also generated by clever new inventions, but they were in short supply at the Faire. Lots of "me too" products were on display... whatever happened to our creativity? Dynabyte put robots on display and dilithium Press released its new publication, *Robots on Our Doorstep*, but both only hinted at what's to come. That leads me to the real message in this article: the maturation of our market.

If our industry trade shows are intended for the insiders—the retailers, computer jocks



Paul J. Terrell

and technically elite—to share innovations in product design and make purchases for the next quarter- or half-year sales, then we owe it to the general public not to invite them.

If our shows are intended for the general public to increase their awareness of personal computing, then we owe it to our industry to give some thought to the educational aspects of the displays we exhibit and, in general, to the whole theme of the show.

Electricity was taken out of the air by a confused and bewildered public audience that couldn't get close enough to the displays they would have enjoyed if they had been told what they were seeing. It's a bit confusing to pass from the IBM booth with \$18,000 computers to the Jade booth with \$2 connectors and try to understand the relationship.

At the San Francisco Boat Show a person can spend \$3 for an afternoon of entertainment and education in one of Amer-

ica's favorite pastimes. Isn't that what we want of our industry?

At the Consumer Electronics Show the public isn't invited and the guests are grouped according to their buying power by brightly colored badges that distinguish the tire kickers from the chain-store buyers.

We had all the elements at the Computer Faire for a most enjoyable time—technical seminars for education, contests of computer chess for entertainment and display of new products to ponder and purchase—but something was missing. It's the same thing that is missing in most computer stores today: a guided tour... a menu... a flowchart. We need to display in the most obvious ways if we are going to bring our secrets of high technology to the public.

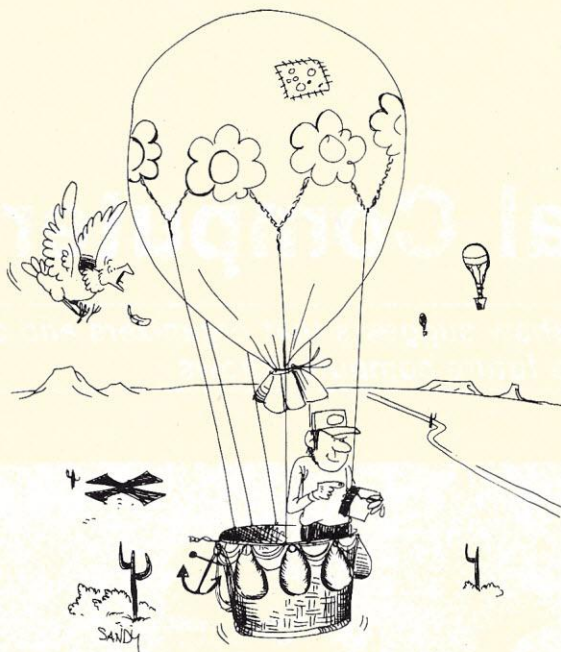
As our market matures from the technical activist to the consumer, so should our showmanship. Let's invite everyone to experience the personal-

computer evolution in a format understandable to all. Let's bring back "The Greatest Show on Earth" in the form of "Computer Expo."

Let's not forget the obvious help available from the product we display. *Business Week* called them "smart machines"; seems to me they should display, entertain and sell themselves. "Isn't that right, HAL?" (HAL is the computer renegade that took over the spaceship and plotted the destruction of its master in the movie *2001: A Space Odyssey*.)

While push went to shove on the exhibit floor of Computer Faire, plans for a U.S. Personal Computer Show were being presented in a dimly lit suite at the Holiday Inn. The significant point was the format of manufactures being grouped in industry segments (hobby, home entertainment, small business, education and industrial). The product presentations were more an education on computers in the home, business, industry, etc., than attributes of one machine versus the next. Contests and interaction of man and machine were most obvious in the home-entertainment area. Retailers were in storefronts and classes on computer applications were filled with the naive.

With an organized and concerted effort we could bring this "Computer Expo" of the future to Main Street, U.S.A., today. Let's get the organizers and showmen of personal computing together. In combination, their resources would give you and me "The Greatest Show on Earth" in the 1970s. ■



Cross-Country Balloon Trip

Take flight with this very entertaining game for you and your SR-52.

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```

000      LBL E
002      CMs
003      - RCL 99 = x2  $\sqrt{y}$  7 = STO 99
015      1001 HLT
020      LBL A
022      RCL 99 - .2 =
029      if pos 9'
031      12 SBR 1' GTO 2'
037      LBL 9'
039      45 - 3 SBR 1'
045      if pos 2'
047      + 360 =
052      LBL 2'
054      STO 01
057      1 SUM 19
061      SBR 1' STO 00
066      ÷ 100 + RCL 01 = Fix 2
077      INV st flg 0 HLT
081      LBL B
083      if flg 0 3'
086      fix 0 D.MS STO 04
092      - 1 = X (RCL +/- +19) =
104      INV if pos 3'
107      RCL 04 PR OD 00
113      RCL 01 P/R D.MS SUM 03
121      RCL 00 D.MS SUM 02
128      (RCL 02 - 1001)x2 + RCL 03 x2 =  $\sqrt{x}$ 
146      - 15 =
150      if pos 4'
152      RCL 19 A' HLT
157      LBL 4'
159      + 15 =
163      st flg 0 HLT
166      LBL 3'
168      INV fix 1 ÷ 3 = A' HLT
176      LBL 1'
178      X 30 X ((7 yx 9 X RCL 99 X .00001) - (RCL - .5)
206      fix 0 D.MS) STO 99 = D.MS rtn

```

Initialization
Clear registers R00 thru R19
Process input and store for "seed"
Display 1001 and wait
Each press of A brings a new day . . .
Using subroutine 1', find direction
wind blows toward. Easterly is
heavily favored.

Subroutine 1' was adapted from Peter
Stark's pseudo random number
generator in "SUBMARINE"
(KILOBAUD Feb 1977 p. 70)
Store direction in R01 (⊖)
Count days (increment R19)
Find wind velocity (0 to 30) and store
Display wind direction and velocity
Authorize a launch and wait
Press B to launch the balloon
Error if launch not allowed
Round input to nearest integer and store
Check size of rounded input. Error if
less than 1 or greater than 20
Distance travelled (r) is now in R00
Convert to rect. coords. Store y in R03
Store x in R02
Compute distance from goal
Closer than 15?
If no, continue the game
Game over! Flash number of days
Game continues
Repair distance to goal
Revoke launch permit and wait
Error section
Flash .3333333333
Subroutine 1'

Note: Angular mode switch must be set at "D"

Program listing.

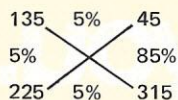
Your balloon starts 1001 miles (use kilometers if you wish) due west from your goal. Each day you are given the wind direction and velocity and decide whether or not to launch. If you choose to launch, you decide how long to stay aloft (from 1 to 20 hours). The game ends if you land closer than 15 miles from the goal. The number of days is flashed.

You will need paper, pencil, protractor and ruler. Using any appropriate scale, locate the goal 1001 miles due east from the start. The program uses the convention for directions that is shown in Fig. 1.

1. To begin a game, load the program and enter any number (6 digits or so).

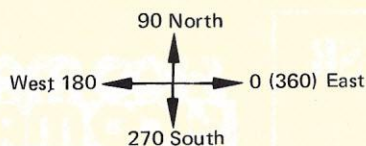
2. Press E. The display will show 1001, your distance from the goal.

3. Press A. The display shows the direction in which the wind is blowing and its velocity. The format is ddd.vv. Note: the wind blows mostly in an easterly direction. In fact, 85% of the wind direction will be between 315 and 45 (SE to NE). Of course, any game may differ from these expectations.



4. Make launch decision. If no, go to step #3 for next day's wind. If yes, enter a whole number from 1 to 20 and press B. Your balloon will travel that many hours. The display shows how far from the goal you landed. Plot your trip carefully. Go to step #3.

5. If you land closer than 15 miles from the goal, the display flashes the number of days. Press CE to stop the flashing. Go to step #2 for a new game. Flashing .333333333 indicates an error (like if you specify a 22 hour flight). Press CE and try again. ■



(In terms of rectangular coordinates, you start at 0,0; the goal is at 1001, 0.)

Fig. 1. Conventional compass directions are used to form game board.

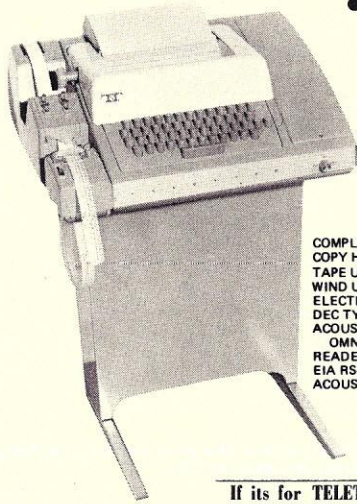
	Enter	Press	Display	
(R99 = 0)	1977	E	1001	
		A	354.12	
	20	B	762	
		A	347.13	
	20	B	516	
		A	337.28	
		A	327.20	
		A	333.18	
	20	A	7.18	
		B	157	
		A	318.24	
		A	42.10	
		A	6.27	
	4	B	53	
		A	342.09	
		A	349.28	
		A	352.14	
		A	18.15	
		A	36.04	
	13	B	Flashing 14	You arrived within the goal circle in 14 days. Final location was (998,3).
	Enter	Press	Display	
(R99 = 0)	354	E	1001	
		A	352.23	
	20	B	549	
		A	36.19	
	20	B	286	
		A	326.06	
	20	B	167	
	A	A	205.12	
		A	2.18	
		A	23.07	
		A	10.01	
		A	269.16	
		A	325.11	
	15	B	Flashing 9	Reached the goal in 9 days. Final location: (.997, - 3).
	Enter	Press	Display	
(R99 = 0)	408	E	1001	
		A	320.14	
	20	B	807	
		A	353.01	
		A	180.05	
		A	270.21	
		A	39.03	
		A	8.09	
	20	B	628	
		A	40.14	
	20	B	396	
		A	315.16	
	18	B	262	
		A	349.17	
		A	40.15	
	10	B	113	
		A	348.11	
		A	338.17	
		A	343.02	
		A	306.26	
		A	25.05	
		A	134.10	
	12	B	159	
		B	.3333333333 Flashing. Press CE	
		A	357.00	
		A	335.17	
	5	B	88	
		A	333.21	
		A	340.21	
		A	9.25	
		A	327.26	
		A	330.14	
		A	322.09	
		A	25.07	
	13	B	Flashing 25	Reached the goal in 25 days. Final location: (1001, 5)

Sample runs.

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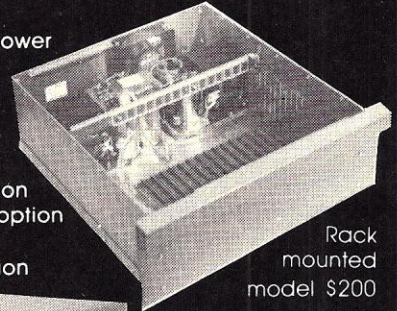
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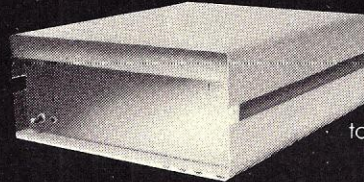
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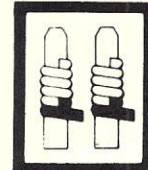
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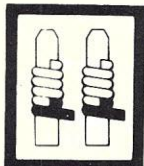
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Transfer Vectors vs Absolute Addressing

You can save memory by reusing program modules and algorithms.

William Nichparenko
Sunick Systems
185 Summit Dr.
Santa Cruz CA 95060

Those of you involved in heavy assembly language programming will find Bill's article very worthwhile. He's

discussing the technique of using transfer vectors which, incidentally, was the subject of an article by Art Childs in Issue #1 of Kilobaud. Art discussed the use of the

transfer vector with regard to accessing I/O routines ... Bill's approach deals with using the transfer vector as opposed to absolute addressing. — John.

If you are not fortunate enough to have a sophisticated operating system, but would like to have some modular software that you can use with ease, the follow-

Machine Language			Assembly Language			
Hex Location	Operation Code	Label	Mnemonic	Operand	Comment	
6F7	7E 0802		ORG	\$6F7	ORIGIN FOR OBJECT CODE	
6FA	7E 07FA		JMP	C	JUMP TO LABEL C	
6FD	7E 0721		JMP	B	JUMP TO LABEL B	
Entry → 700	CE E000	Z	JMP	A	JUMP TO LABEL A	
X	X X X		LDX	\$E000	BEGIN PRINT A ACCUM. SUB	
X	X X X		X	X	X X	
721	7D 01FF	A	X	X	X X	
X			TST	\$1FF	BEGIN CARRIAGE MOVE SUB	
X						
7FA	86 1F	B	LDAA	#\$1F	BEGIN PAPER MOVE SUB	
802	B1 07A0	C	CMPA	\$7A0	BEGIN END OF LINE CHECK SUB	
8A0	39		RTS		RETURN TO MAIN PROGRAM	

Fig. 1. Assembly language representation of the module and the object code generated.

ing method may be of interest to you.

The Problem

Suppose you have a software module called Printer Control (known as the base module from here on). Fig. 1 is arranged so that the assembly language representation of the module and the object code (or machine language) that it generates are adjacent for easy comparison. This module has a reference entry point of 700 hexadecimal, used whenever entering the module by itself. The purpose of the module is to take a byte of information in the A accumulator, operate on it, and return to the main program when completed. This base module contains various subroutines within it

(for illustration purposes call these subroutines A,B,C) that are useful to other modules. For example, a TAB module, entirely separate from the Printer Control module, may want to use subroutine A of the base module to perform a carriage movement without printing any letters. The problem that arises is that other modules, not having been assembled at the same time as the base module, must call the subroutines A, B, and C by absolute addresses (i.e., a machine code value in hex or octal as opposed to a symbolic address). This is fine as long as none of the addresses in our base module change. Unfortunately, any time you want to modify the base module, many of the sub-

routine call addresses in all the other modules using the base module subroutines may have to be changed. This is a time consuming and error prone process.

The Solution

A simple solution is to place a transfer vector (a collection of jump commands pointing to the locations of assembly language subroutine labels A, B, C) in front of the module's object code. The absolute address of the transfer vector never changes, but the addresses within the module that correspond to subroutines A, B, and C are changed every time the module is altered and re-assembled.

If new subroutines are added to the module, a new

bytes of memory are needed for each new jump instruction). Note also how the absolute addresses of each subroutine have changed, and how the corresponding jump command operands in the transfer vector have changed accordingly. A subroutine call to location 6FA will enable the use of subroutine B in either the old or the new edition of the base module.

Fig. 3 shows how the base module can be used in any one of the three possible modes. The first mode is a direct call to the base module at location 700 hexadecimal. This uses the full capability of the base module to call each of the three subroutines A,B,C as needed. An important point to note is that each of the subroutines within the

Machine Language				Assembly Language		
New routine added.	Hex Location	Operation Code	Label	Mnemonic	Operand	Comment
	6F4	7E 0762		ORG	\$6F4	ORIGIN FOR OBJECT CODE
	6F7	7E 0843		JMP	D	JUMP TO LABEL D
Old addresses still valid.	6FA	7E 0811		JMP	C	JUMP TO LABEL C
	6FD	7E 0721		JMP	B	JUMP TO LABEL B
	700	CE E000	Z	LDX	\$E000	BEGIN PRINT A ACCUM. SUB
Entry point unchanged.	X	X X X		X	X	X X
	X	X X X		X	X	X X
	721	7D 01FF	A	TST	\$1FF	BEGIN CARRIAGE MOVE SUB.
	762	BB E000	D	ADDA	\$E000	BEGIN PAPER OUT CHECK SUB
	811	86 1F	B	LDAA	#\$1F	BEGIN PAPER MOVE SUB
	843	B1 07A0	C	CPMA	\$7A0	BEGIN END OF LINE CHECK SUB
	921	39		RTS		RETURN TO MAIN PROGRAM

Fig. 2. Address changes with new subroutine (D).

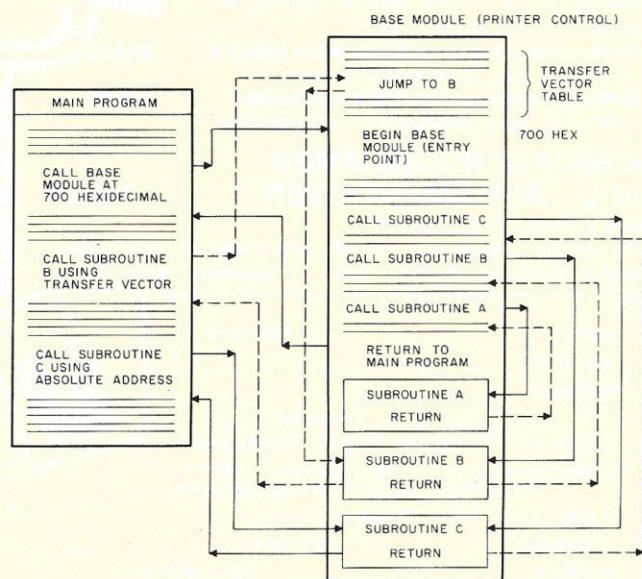


Fig. 3. Various uses of base module.

jump instruction is appended to the transfer vector so as to not change the absolute addresses of the jump instructions contained in its earlier versions. The only thing that need be remembered is to arrange the assembler origin such that the reference entry point to the module does not change.

Fig. 2 shows how various addresses might change with addition of a new subroutine, labeled D, to the module. Note that a new assembler origin of 6F4 is necessary to maintain the absolute addresses of the old transfer vector and the reference entry point of the base module (three additional

base module must have its own return command in order to be useful outside the base module. Upon completion, the base module returns control to the main program.

The next call from the main program illustrates the use of the transfer vector to call subroutine B in the base module. Finally a direct call to subroutine C at its absolute address illustrates what we are trying to avoid by the use of a transfer vector. If the address of C changes due to a modification in the base module, so must the absolute call in every main program that uses subroutine C directly. ■

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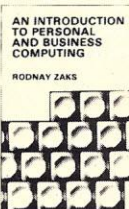
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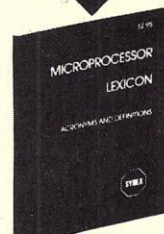
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Error Correcting Codes

Error correcting codes are a software technique for detecting and correcting hardware errors that sometimes occur in data-transmission systems.

Most of us are familiar with detecting errors using a parity bit. The ASCII 7-bit code is usually accompanied by an 8th bit which is set either as 0 or 1 depending on whether the first 7 bits have an even or odd number of bits turned on (or set to 1). The kind of parity is either even or odd depending on whether or not the entire 8 bits have an even or odd number of bits on. Since the 8th bit is set on or off as a result of the first 7 bits, every set of 8 bits can be sent with the identical parity. At the receiving end, all we need to do is check each 8-bit string for its parity; when one comes along with the wrong parity, we have detected an error. Unfortunately, we have no idea which bit has been clobbered in the channel, and therefore we must request that the string be retransmitted.

Checksums perform the same sort of basic function (detecting errors), but they

too suffer from the inability to indicate where the error(s) occurred. Also, since checksums occur after several strings of bits have been sent, a checksum error means that the whole message must be resent. If the channel is

bit 1	bit 2	result
0	0	0
1	0	1
0	1	1
1	1	0

Table 1. Truth table for the Exclusive OR operation.

One way to interpret this operation is to view the result as a parity bit which results in even parity. Thus, if we have a string of bits such as 001011 and perform the Exclusive OR $0 \oplus 0 \oplus 1 \oplus 0 \oplus 1 \oplus 1$ the result would be 1. Being able to do Exclusive ORing on a string of bits is necessary when more bits are involved in each message string (more than just one like in this first example). Another way to get the result of a string of EX ORs is to find out how many 1s there are, and if the number is even, the result is 0; if the number is odd, the result is 1.

subject to much noise, we can expect at least a few errors in a long message, and we may end up sending and resending the message several times before an error-free message is received.

With a few extra parity bits interspersed throughout the string of bits, we can not only detect errors but also locate the bit in error, invert it, and have a correct message received without having to send the message more than once. This sort of parity checking (with extra parity bits) is known as error correcting, a bit more sophisticated and helpful than simply error detecting.

Error Correction — Needs More Parity Bits

In order to have a coding scheme that not only detects errors, but corrects them, it seems only natural to have to pay a price. The price is in terms of extra parity bits. For short strings of bits, the

parity bits occur almost as frequently as the message bits. In fact, to send a single bit and detect and correct errors, two parity bits are required. An example will help clarify this point, but in words we must be aware of the fact that errors can occur in the parity bit(s) as well as

Position
Binary Address

0	0 0 0	
1	0 0 1	P
2	0 1 0	P
3	0 1 1	M
4	1 0 0	P
5	1 0 1	M
6	1 1 0	M
7	1 1 1	M

Table 2. The parity bits are at positions in which only a single bit is on. Look down a column. Wherever there are 1s in the column, note the positions. There will only be one parity bit in each column and three message bits. (In general, $(2^{n-1}-n)$ message bits will be used to encode each of the n parity bits.)

in the message bit(s). If such an error does occur, we want to be sure that we don't assume that the message bit was in error and invert it by mistake.

One Message Bit

Suppose we have only one bit to send, which we shall label as M. The error correcting code will have three bits in total: M and two parity bits, P₁ and P₂. The string will look like MPP, or better, M₃P₂P₁ with the subscripts indicating which bit is sent first. M₃ means that the message bit will be the third bit in the string. Now we must know how to encode the parity bits P₁ and P₂.

The error correcting code discussed here depends heavily on the use of the Exclusive-OR logical function (see Table 1). The notation \oplus will be used to indicate Exclusive-OR.

Let's set P₁=M₃ and P₂=M₃ and see what happens. If the message is M=1, the string will be 111. Now at the receiving end, the string is analyzed by determining the results of the Exclusive OR checks shown in Example 1.

Believe it or not, this check indicates that there is no error in the string. Reading from the top down, the two 0s indicate that error occurred in the 0th bit (which does not exist).

One Message Bit — One Error

If an error in transmission had occurred, one of the bits in the message would have been a 0 instead of a 1. If the first bit were the source of error, the received message would have been 110 and the check would have given Example 2. This indicates that the error occurred at location 01 binary, or the first bit (which we knew because we made the error in bit 1). If the error occurred in bit 2, the received message would have been 101 and the check would be Example 3. This indicates an error in bit 10 or bit 2 (10 is binary for 2). Of course, had the error

$A_1 = P_1 \oplus M_3 = 0$ $A_2 = P_2 \oplus M_3 = 0$ <p style="text-align: center;"><i>Example 1.</i></p>
$A_1 = P_1 \oplus M_3 = 0 \oplus 1 = 1$ $A_2 = P_2 \oplus M_3 = 1 \oplus 1 = 0$ <p style="text-align: center;"><i>Example 3.</i></p>

$A_1 = P_1 \oplus M_3 = 1 \oplus 1 = 0$ $A_2 = P_2 \oplus M_3 = 0 \oplus 1 = 1$ <p style="text-align: center;"><i>Example 2.</i></p>
$P_1 = M_3 \oplus M_5 \oplus M_7$ $P_2 = M_3 \oplus M_6 \oplus M_7$ $P_4 = M_5 \oplus M_6 \oplus M_7$ <p style="text-align: center;"><i>Example 4.</i></p>

been in the third bit, or message bit, the check would reveal 11 which is binary for 3.

Several Message Bits

There are some fixed number of message and parity bit combinations which are not possible in this single error correction coding scheme. In general, it is the number of parity bits which fixes the number of message bits included in each distinct string of bits. The number of bits in a string is $2^n - 1$ where n is the number of parity bits. For the two parity bit example, $2^2 - 1 = 3$, the total number of bits in the string. The number of message bits in the string is, therefore, $(2^n - 1) - n$. What does this mean if we try 3 parity bits instead of 2? Plugging in we get $2^3 - 1 - 3 = 4$ message bits. Thus, the string will be 7 bits long, and there will be 4 message bits and 3 parity bits. Let's jump to 5 parity bits. In this case, there will be 31 bits in the message, and 26 message bits. The ratio of information (message bits) to

checking (parity bits) improves as the strings get longer. But as we will see, the amount of processing needed during encoding and decoding also increases as the length of the string increases.

In this example using 7 bits (4 message and 3 parity), we will assume that you understand the Exclusive OR operation and binary notation. The first problem is to locate where the parity bits belong. Mathematically, they are put in locations 2⁰, 2¹ and 2² which is easily generalized, meaning that for n parity bits, the ith one belongs in position 2ⁱ-1. For our three parity bits, this means they are the first, second, and fourth bits in the string. The message bits are put in the unused positions, which are 3, 5, 6 and 7.

To determine the coding for the parity bits we'll give you a scheme later. For now, just the notation will do. First, our string will look like this:

M₇ M₆ M₅ P₄ M₃ P₂ P₁
and is sent out by shifting it

to the right one bit at a time (e.g., serial transmission across the phone lines or into a cassette recorder). The parity bits are determined using the message bits in Example 4.

This may appear at first to be sort of random, but look closely. The parity bits occur at positions such that any combination of 0s and 1s for them will encode a binary address from 0 to 7 by adding up the position numbers (which we will find out is the address of the bit which is in error). Also, the positions of the message bits are such that only those in which bit 1 is on (for positions 3, 5, and 7 in binary) are used to encode parity bit P₁. P₂ is encoded using the message bits in locations in which the second bit of a three bit binary address is coded as 1, which are positions (addresses) 3, 6 and 7. Likewise, P₄ uses the bits located in positions in which the third bit of a three bit binary address is 1. A look at the list of numbers in Table 2 will help.

The position 0 (000 binary) is not used during the encoding. For the rest of the table, the columns are the key thing to look at. The parity bit being encoded will be associated with three message bits, found by the positions in which a 1 is found in the column along with the 1 associated with the parity bit. The first parity bit is in position 1, and in that column, positions 3, 5, and 7 also have a 1.

The next step is to take a message (any 4-bit message will do) and encode it into a 7-bit string. I chose the message 0111 which is hex 7. (The important thing to keep consistent is which way to read the message. The bits are to be shifted right if they are serialized.) In this 4-bit message, the individual message bits are: M₃ = 1, M₅ = 1, M₆ = 1, M₇ = 0. The parity bits are shown in Example 5. The entire string of bits will be (starting with bit 7 on the left) 0110100.

$P_1 = 1 \oplus 1 \oplus 0 = 0 (= M_3 \oplus M_5 \oplus M_7)$ $P_2 = 1 \oplus 1 \oplus 0 = 0 (= M_3 \oplus M_6 \oplus M_7)$ $P_4 = 1 \oplus 1 \oplus 0 = 0 (= M_5 \oplus M_6 \oplus M_7)$ <p style="text-align: center;"><i>Example 5.</i></p>
$A_1 = P_1 \oplus M_3 \oplus M_5 \oplus M_7 = 0 \oplus 1 \oplus 1 \oplus 0 = 0$ $A_2 = P_2 \oplus M_3 \oplus M_6 \oplus M_7 = 0 \oplus 1 \oplus 1 \oplus 0 = 0$ $A_4 = P_4 \oplus M_5 \oplus M_6 \oplus M_7 = 0 \oplus 1 \oplus 1 \oplus 0 = 0$ <p style="text-align: center;"><i>Example 6.</i></p>

Now let's send this message with no errors. At the receiving end, the string is processed by performing Example 6. The address of the error is 000, or position 0, which is not in the string. If none of the bits have changed during transmission (no errors) then it makes sense that each of the Exclusive ORs should result in 0s. Remember, P_1 was the result of $(M_3 \oplus M_5 \oplus M_7)$ and therefore, doing the checking is like doing the following: $(M_3 \oplus M_5 \oplus M_7) \oplus (\bar{M}_3 \oplus \bar{M}_5 \oplus \bar{M}_7)$ where the M means the received message bits. We can reorient this expression as $(M_3 \oplus \bar{M}_3) \oplus (M_5 \oplus \bar{M}_5) \oplus (M_7 \oplus \bar{M}_7)$ which compares each message bit before and after transmission. If no change has resulted, the \oplus will be 0 for each pair (a bit \oplus d with itself is 0), but if a single bit has inverted due to error, the result will be a 1. Studying this a bit longer (no pun intended) will show you how the scheme will give you the

$A_1 = P_1 \oplus M_3 \oplus M_5 \oplus M_7 = 0 \oplus 1 \oplus 0 \oplus 0 = 1$ $A_2 = P_2 \oplus M_3 \oplus M_6 \oplus M_7 = 0 \oplus 1 \oplus 1 \oplus 0 = 0$ $A_4 = P_4 \oplus M_5 \oplus M_6 \oplus M_7 = 0 \oplus 0 \oplus 1 \oplus 0 = 1$ <p style="text-align: center;"><i>Example 7.</i></p>
$P_1 = M_3 \oplus M_5 \oplus M_7 \oplus M_{11} \oplus M_{13} \oplus M_{15} \oplus M_{19} \dots \oplus M_{31}$ <p style="text-align: center;"><i>Example 8.</i></p>
$A_1 = 01010101 \quad \bar{A}_1 = 10101010$ $A_2 = 01100110 \quad \bar{A}_2 = 10011001$ $A_4 = 01111000 \quad \bar{A}_4 = 10000111$ <p>(The bar means not or complement, or in this case, when $A_n = 0$.)</p> <p style="text-align: center;"><i>Example 9.</i></p>

actual position of the error.

A 7-Bit String with One Error

Using the same message bits as before, let's find out what we'd do if we received the following message: (don't look back at the original string just yet) string =

0100100. We know this is a 3 parity bit code, and the parity bits are in locations 1, 2 and 4, thus $P_1 = 0$, $P_2 = 0$, and $P_4 = 0$. Also, the message bits are $M_3 = 1$, $M_5 = 0$, $M_6 = 1$, and $M_7 = 0$. Now let's decode the address of the error, if any, in Example 7.

The address of the error is position 5, read from A_4 and A_1 , both being on; their sum is 5. Now correct the string to read 0110100 (invert position 5's bit from a 0 to a 1) which is the proper string. The message bit was in error in this case, but in others, the parity bit may have been the one in error. Rather than correcting the string, it might be quicker and more efficient simply to check the address to determine whether parity or message bits were involved and ignore the correction if a parity bit was in error (who cares about parity bits after the message has been sent?).

Try doing the error checking for other position errors. Also, where there are two errors, this system will not locate the address of the error, but it will indicate that an error was received (one or more of the error address bits will be on). This error correcting code will handle most errors as long as the error rate is fairly small (so that two errors are not likely to occur in the same string).


What to do with Error Correcting Codes

The 7-bit string used in the example only allows 4 message bits to be sent with each 3 parity bits. This sounds inefficient, and in terms of getting a lot of data through a channel it is. However, it helps eliminate an occasional missing bit, which may be even more disastrous than a slower effective bit rate. With 5 parity bits, the relative number of parity bits is substantially reduced compared to the number of useful data bits. The 31 bits in a string result in 26 message bits, which is enough to encode 3 8-bit bytes with 2 extra bits which are of little use. The problem with the 31 bit message is the number of Exclusive ORs needed. For example, the first parity bit is found using the calculation in Example 8.

Another problem for the programmer is how to do bit-specific Exclusive ORing efficiently. Hopefully, an article will appear describing a program to implement the 7-bit string error correcting coding in the near future. As a start on the programming, put masks in memory as shown in Example 9.

If it is determined that the location of the error is $A_1=1$, $A_2=0$, $A_4=1$, then use the AND function to AND A_1 , \bar{A}_2 , A_4 which will result in the following mask in the Accumulator: 0001000. Simply \oplus this with the received string, and the proper bit will be inverted, which is bit 5. Note also that by ANDing A_1 with the string, only bits 1, 3, 5 and 7 can get into the Accumulator, at which time you need only to determine the parity (number of 1 bits) and if it is even, the result will be 0 indicating that as far as the A_1 portion of the position, use \bar{A}_1 mask. Whether to use A_2 or \bar{A}_2 mask, AND A_2 with the string, determine the parity, and select A_2 or \bar{A}_2 depending on whether the results are odd or even respectively. ■

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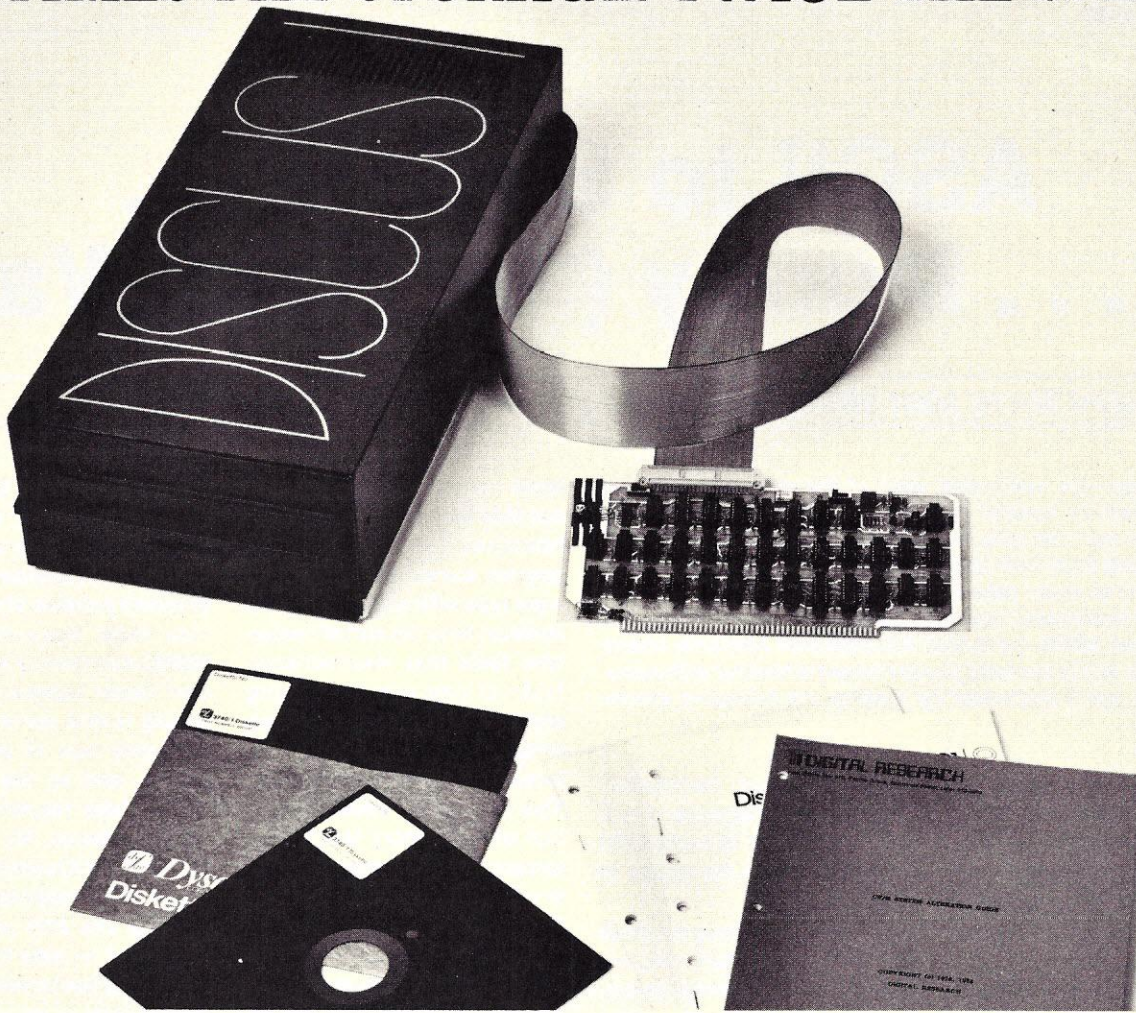
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Ray Graham
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Publisher's note: The Baudot referred to in this article is actually Murray code as per my remarks on page 4. Have we all been the victim of a dastardly French revisionism plot?

ASCII to Baudot . . . er . . . Murray (the Hard Way)

Mini Micro Mart strikes again—as you will see in this consumer report.

And so it goes—the continuing saga of the computer hobbyist community and its special relationship with Mini Micro Mart. Naturally, you won't be able to get into this relationship until you order something from Mini Micro Mart; and then you'll find out (as John, Ray and so many others have) why it is a special relationship. Without hesitation, I can recommend at least one product for you to buy from MMM: the GPA-B ASCII/Baudot converter board. The reason for this is because you can become familiar with possible problems you'll encounter by reading the following article. —John.

The Mini Micro Mart GPA-B is a kit that converts parallel ASCII to serial Baudot. This is obviously a very useful device for hams and computer hobbyists who have Baudot teleprinters, such as the models 15, 19 and 28. These are frequently available and quite inexpensive; many hams have them already. Conversion from ASCII to Baudot can be done in either hardware or software; a hardware conversion system can save a couple-hundred bytes to be used for other pur-

poses in your computer. Whether this particular hardware conversion is worthwhile will be left up to the reader to judge—read on!

For those who have not dealt with Mini Micro Mart, they are located at 1618 James Street, Syracuse NY 13203. They offer quite a range of computer equipment, both surplus and kits, at very low prices. Cynics might observe here that you usually get what you pay for; this is not far from the truth.

One of Mini Micro Mart's

most recent bulletins points out that they cater to the "true hobbyist." This particular species is a subset of the hardware type with whom we are all familiar; he is the sort of person who feels that Heathkit-style instructions are demeaning and that (one gathers) finding errors in design and manufacture is an interesting challenge. This is a rather recent definition of Mini Micro Mart's customers; it did not exist (at least in print) when I bought the kit. But since they specify who their ideal customers are, let us now explain who we are so that readers can judge how well we fit the mold.

"I" in the rest of the article refers to John, K8UP (as in microprocessor). I am a ham (since 1964) with the usual experience with a combination of home-brew, kit and commercial ham gear. Digital electronics is fairly new to me, although I have been programming computers for a couple of years now. As a computer hobbyist, I am definitely a "software type."

Ray is a hardware type—an electronics technician by profession, as well as by avocation. His background, like mine, is mostly in communications electronics. We are both members of the Ann Arbor Computer Club, which is the source of this collaboration.

More on MMM

Mini Micro Mart does not ser-

vice what it sells. Until a few months ago, their customers were forced to live a catch-as-catch-can existence scurrying to locate suitable shops to service their equipment; now MMM recommends an independent repair service. Their reasoning is that some people do not know how to put kits together, and so the company cannot take responsibility for resulting errors. My own opinion (for what it is worth) is that if MMM took responsibility for making the kits work, they would not be able to send out erroneous documentation, defective parts or incomplete kits the way they do now.

What I received in this instance is pictured in Photo 1; documentation consists of a parts list, a schematic and a layout diagram. The schematic and the layout (at least for this kit) were not in agreement. Part of the reason for this seems to be that MMM makes several ASCII/Baudot conversion boards . . . and they use the same documentation for all of them!

Only by comparing the parts shipped with the parts list (which again does duty for three kits) and figuring out what everything on the schematic does is it possible to figure out what is needed for the GPA-B kit. For those who have trouble, a corrected schematic is given in Fig. 1. This modification contains additions and corrections (more on

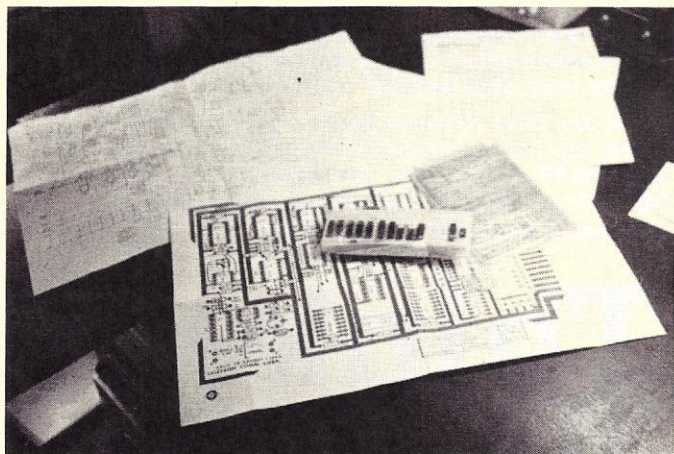


Photo 1. What was shipped.

these later) but does not include the parts for different kits. Incidentally, I never did receive all the parts for this kit; fortunately, the missing ones were available locally. If this keeps up I may turn into a true hobbyist!

Now for the history of the kit. The circuit was originally published in *Radio Electronics* in March 1976. In the original publication there were a couple of errors, which were corrected the next month. Not all of these are corrected in the GPA-B (I presume that the folks at Mini Micro Mart do not believe in testing their kits before they put them into production and sell them).

I ordered the kit (for \$35), along with a surplus keyboard, in early February 1977. The key-

board came a few weeks later with a note that the GPA-B would be delayed about a week. After a month of waiting, I wrote the company to ask what had happened. No answer. Two months from the time the keyboard arrived, I again wrote. This time I was informed that the board had not been shipped because MMM didn't have any. They did have a similar board ... would I accept that? I said yes.

Three weeks later at a computer fair in Cleveland, I ran into Mini Micro Mart representatives who said they didn't have any of the boards yet (they had one as an exhibit and were taking orders for them), but that it wasn't their fault and they would ship one right away. They were obviously not too en-

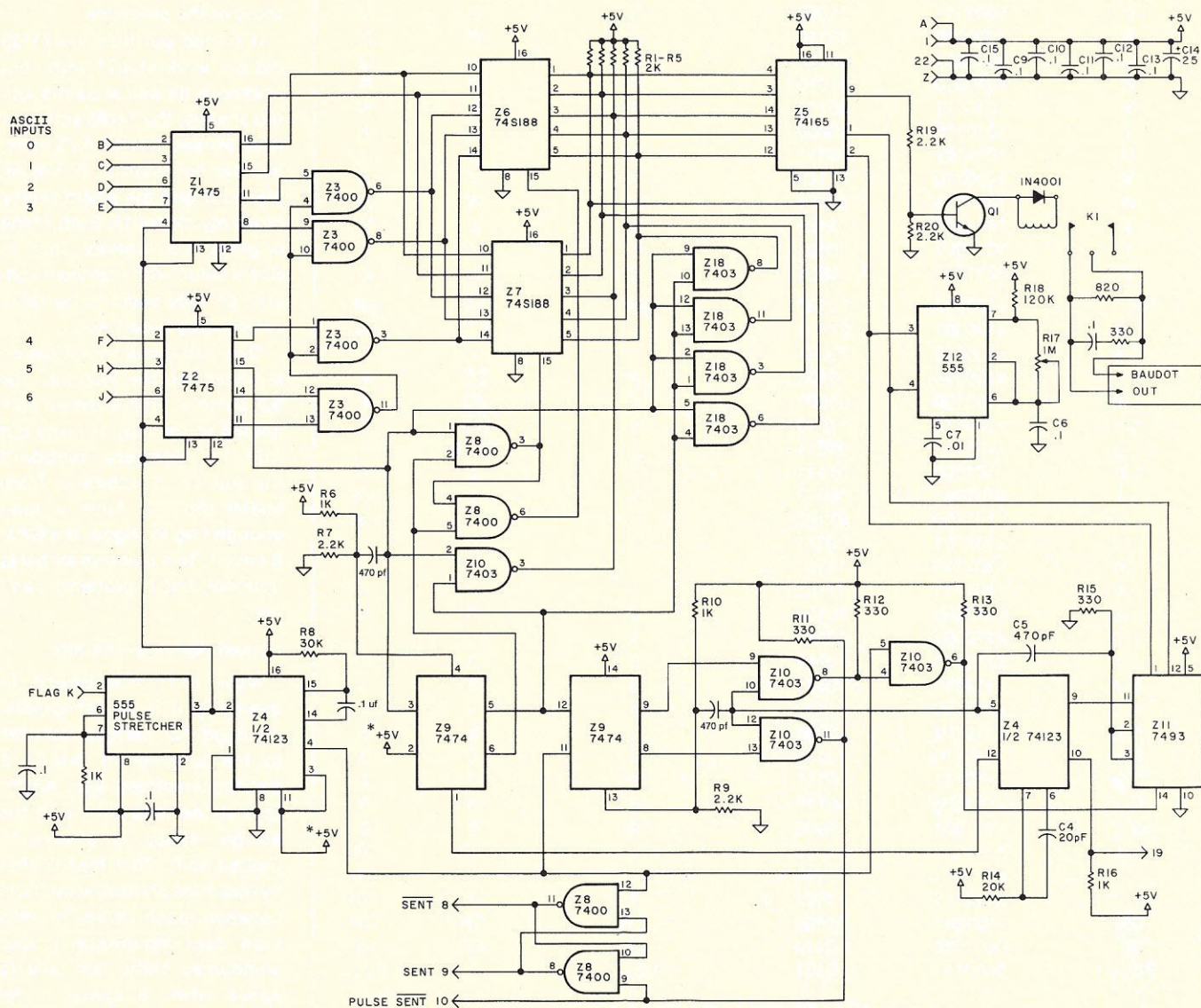
thused about my scaring away customers, although a couple of other people at the show commented that they, too, were having problems with orders.

Two weeks later, still nothing. I called. Yes, they had them and one would be sent the next day. A few weeks later it came—over four months from the time I ordered it (prepaid, of course). I read the directions (half page), checked for non-plated-through holes with a magnifying glass (I should have used an ohmmeter) and built the thing—after going out and buying IC sockets. It didn't work.

First, I compared all parts with parts layout. No problem. Then, using an ohmmeter, I compared the schematic to the board. In addition to the un-

plated-through holes I had caught with the magnifying glass, there were 27 additional holes that had either been bad to begin with or had come unplated when I inserted the IC sockets. I repeat: *twenty-seven* bad plated-through holes. Ray later found three more; it would have been much easier if the kit had been sold as not having plated-through holes, then I would have soldered everything on both sides to begin with.

"Mini Micro Mart recognizes a responsibility to provide the highest quality components, whether sold as individual items or as part of a kit." So reads the manual. Yep. I might add that Mini Micro Mart not only recognized its responsibility to provide the highest quality components in the form of



the board, but also included three bad ICs. We replaced them locally, rather than return them and risk waiting a couple more months.

After I had spent about 25 hours tracing pulses and soldering bad holes, I gave up

and called Ray. He found a couple more bad holes, two bad ICs, in addition to the one I had found, and two errors in the schematic. Error here means something more serious than mislabeling a part or misnumbering an IC pin, which also

happened.

The first problem was that the clear pins on the 74123 were left floating, rather than being tied high. Although not exactly an error, this is not considered good practice because the pins are susceptible to noise. They

were tied high as shown on the corrected diagram.

The second problem was that pin 2 of the 7474 was grounded rather than high. This causes the board to shift from figures to letters, but not shift from letters to figures. This was an error in the original unit. After many hours of work, Ray corrected the problem and brought the unit back to me.





I plugged it in expecting no problems. No such luck; I was plagued by the same problems that Ray had already solved. A couple of hours of circuit tracing were unproductive, but I did notice that the transformer on my bench supply was getting very hot. I checked the voltage with the GPA-B connected and read 4.75 volts. So I quickly built another supply with heavier components. This solved some of the problems.

It turned out that the 74123 did not work at 4.75 volts, but worked quite well at 5 volts. Unfortunately, the 74165 shift register worked fine at 4.75 volts, but did not work at 5. We replaced it and the board finally drove my model 15. Both of the original ICs worked fine in Ray's setup with unknown voltage, so they seem to be fairly sensitive to such things.

One additional modification is shown on the diagram: the 555 pulse stretcher shown connected to the flag. It turns out that my Sanders keyboard (ironically, purchased from MMM) did not have a long enough flag to trigger the GPA-B circuit. This pulse stretcher is optional, but it probably can't hurt.

Up and Running—Finally

Now that the board is operating, it is an acceptable, although not perfect, solution to the problem of driving a Baudot teleprinter with ASCII. One of the problems is in the design—space is always in figures shift. This means that the machine shifts and unshifts between each word—a less than ideal occurrence. It also sometimes shifts but fails to space when a space is received. If the board is run continuously for very long it gets

ASCII Symbol	Bits	Baudot Bits	Communications	CCIT	Bell
A	1000001	00011	A	A	A
B	1000010	11001	B	B	B
C	1000011	01110	C	C	C
D	1000100	01001	D	D	D
E	1000101	00001	E	E	E
F	1000110	01101	F	F	F
G	1000111	11010	G	G	G
H	1001000	10100	H	H	H
I	1001001	00110	I	I	I
J	1001010	01011	J	J	J
K	1001011	01111	K	K	K
L	1001100	10010	L	L	L
M	1001101	11100	M	M	M
N	1001110	01100	N	N	N
O	1001111	11000	O	O	O
P	1010000	10110	P	P	P
Q	1010001	10111	Q	Q	Q
R	1010010	01010	R	R	R
S	1010011	00101	S	S	S
T	1010100	10000	T	T	T
U	1010101	00111	U	U	U
V	1010110	11110	V	V	V
W	1010111	10011	W	W	W
X	1011000	11101	X	X	X
Y	1011001	10101	Y	Y	Y
Z	1011010	10001	Z	Z	Z
SP *	x100000	00100	SP	SP	SP
! a	x100001	01101	!		1/4
" b	x100010	10001	"	+	"
# c	x100011	10100	#		#
\$ d	x100100	01001	\$		\$
& f	x100110	11010	&		&
' g	x100111	01011	'	BELL	'
(h	x101000	01111	((1/2
) i	x101001	10010))	3/4
, l	x101100	01100	,	,	7/8
- m	x101101	00011	-	-	-
. n	x101110	11100	.	.	.
/ o	x101111	11101	/	/	/
ø p	x110000	10110	ø	ø	ø
1 q	x110001	10111	1	1	1
2 r	x110010	10011	2	2	2
3 s	x110011	00001	3	3	3
4 t	x110100	01010	4	4	4
5 u	x110101	10000	5	5	5
6 v	x110110	10101	6	6	6
7 w	x110111	00111	7	7	7
8 x	x111000	00110	8	8	8
9 y	x111001	11000	9	9	9
: z	x111010	01110	:	:	1/8
; :	x111011	11110	;	=	3/8
? :	x111111	11001	?	?	5/8
CR	0001010	01000	CR	CR	CR
LF	0001010	00010	LF	LF	LF
BELL f	0000111	00101	BELL	,	BELL

*X = 1 or 0

Fig. 2. ASCII-Baudot conversion table.

very hot, and sometimes prints garbage. All of that TTL draws a fair amount of current; you could almost fry eggs over the PROMs.

Photo 2 shows the result of the project—a model 15 that works in parallel ASCII. Fig. 2 shows the ASCII/Baudot translation performed by the board. For those who are unfamiliar with Baudot teleprinters, the reason for the three columns is that there are a number of different sets of figures symbols for Baudot teletypewriters. The three illustrated are the most common (aside from the weather keyboard, which contains numerous meteorological symbols).

The communications style is the unofficial standard and the style the GPA-B was designed to match. The CCIT is probably the most common commercial keyboard around at present. The Bell keyboard is found on old Telex machines. When assembling the kit, be sure to put the PROM labeled "L" (Letters) on the top of the board and the

PROM marked "F" (Figures) underneath it. This is not mentioned in the directions.

Conclusion

Ray has three boards from MMM (two of them from a PC-board supplier who no longer makes things for MMM). He got them a couple of years ago and has no complaints about the quality. None of these have been powered up yet, so I can't comment on how well they work.

I don't really enjoy troubleshooting hardware, especially when the problems come from other people's mistakes and carelessness. Had I worked overtime for the amount of time I spent on this kit, I could have bought another computer and done the conversion in software.

Considering delivery, quality and design, I shall let you guess when I will buy anything more from Mini Micro Mart. Of course, if the winter is cold enough, you never know what might freeze over! ■

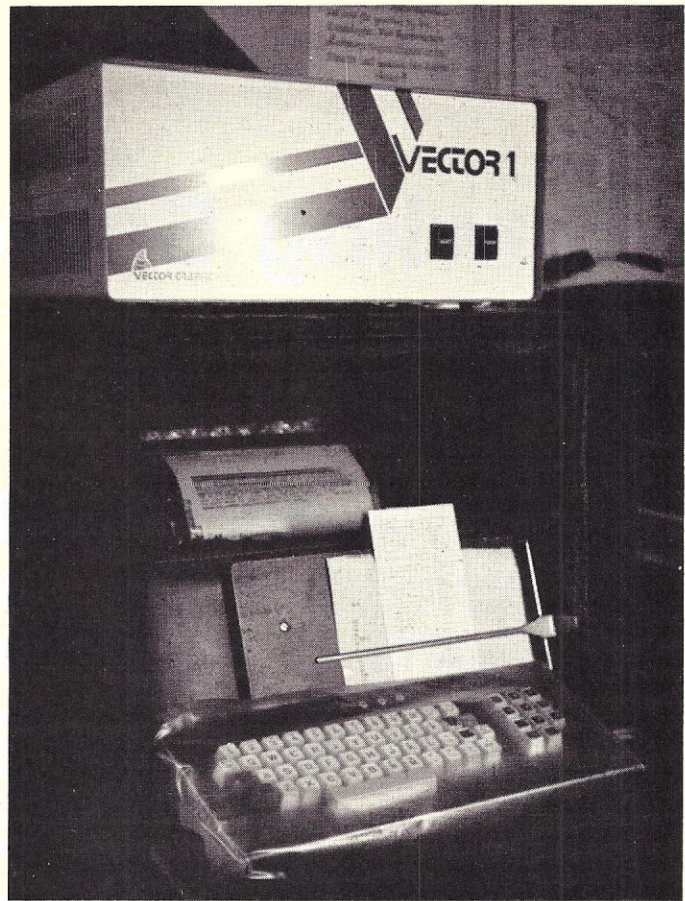
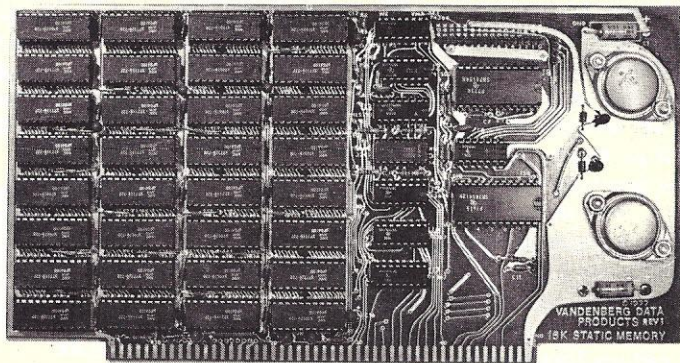


Photo 2. The final result.

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—John.

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Fig. 1d.

Dear Manager,

We are happy to announce the start of a new service for bowling centers that can increase your revenue and facilitate the organization of bowling leagues within your center.

The service being offered is computerized statistics for your bowling league. Normally, this function is performed manually by a person who charges the league between 50¢ to 75¢ per team per week. Our service will be provided to the league through you at a cost of 35¢ per team per week. You, as the manager of a bowling center, can bill the league whatever amount you feel is appropriate. Assuming you charge the league 75¢ per team per week and have three leagues per day with 20 teams each, you would be increasing revenues by \$315 per week. Your profit would be \$168 and \$147 would be paid for our service. We used a 75¢ price to the league in our calculation since our service is superior to anything done manually.

What will you have to do? Very little. The following is a step-by-step outline of the easy procedure:

1. Return the enclosed postcard telling us how many leagues you want us to service and approximately how many teams in each.
2. We will send you forms to give out on opening night of your league. The bowlers will enter their names and average on these sheets. (After opening night your bowlers will never enter their names on a score summary again... our computer will print this information for the remainder of the season.)
3. Fill out a simple form describing the league's rules or send us the league rules. Give us a schedule or ask us to formulate a schedule.
4. Collect the forms.
5. We will collect the forms weekly from you for computer processing or supply an envelope for their mailing to us depending on your volume. At time of collection you will be required to pay for one week's data processing (35¢ per team).
6. The weekly statistics will be delivered to you.

We will attempt to verify all ABC averages and will prepare a year-end list of averages for ABC filing.

Regarding our background, the person assigned to this project has been involved in bowling, bowling scorekeeping and league statistics for nearly 20 years. We can handle any size league, any number of players per team and any set of rules. If you ever become dissatisfied with our service, you can terminate immediately and we will supply you all our data on your league.

Attached is a very short sample of a four-team league and a copy of a weekly score sheet to be filled out by the teams. These are just samples, and actuals will be on four-part paper.

If you want more details, give us a call or just return the enclosed postcard.

Sincerely,

Joseph J. Roehrig

Fig. 1a.

servicing 20 bowling centers.

The problem now is marketing the idea. The approach I recommend is to deal with the bowling center directly and share the revenue fifty-fifty. Why so generous? Because without the cooperation of the center to recruit leagues and to collect scores for the scoring service, there would be no revenues at all. Fig. 1a shows a sample letter that could be sent to numerous bowling centers. A second approach, advertising in bowling trade publications, is shown as Fig. 1d. A person with time to visit the bowling centers could do person-to-person marketing.

After reviewing Fig. 1 and thinking about your share of \$151,200, you should be ready to see how your new business

runs, assuming your marketing has been successful and the customers are clamoring for your service. (The tools I use for processing bowling scores are an Imsai 8080, North Star Disk, 24K of memory, DECwriter, an ADM3, North Star BASIC and the software contained in this article.)

The first question is how to store the data. Initially, my North Star Disk was generating a lot of hard-disk errors (a hardware problem later corrected by the local computer store). Therefore, the software design kept disk reads and writes to a minimum during program executions by assigning an area of memory exclusively for examine and fill (peek and poke in Altair BASIC) operations.

This article will not deal with

Fig. 1. The key to the entire operation lies in your marketing approach. Fig. 1a is a copy of the letter I sent out to various bowling centers. Fig. 1b is a sample of a four-team printout. Fig. 1c is a sample weekly score sheet to be filled out by the teams. Fig. 1d is a sample of another approach—an advertisement in a bowling publication (The Sports Reporter).

NYAC MIXED										01/14/78				
=====														
POS	TEAM		WON	LOST	WIN - LOSS PERCENTAGE	HIGH GAME	HIGH SERIES	AVERAGE		TOTAL WOOD				
=====														
1	RED	(1)	9.0	5.0	.643	738	2112	677.00		4062				
2	GREEN	(3)	7.0	7.0	.500	816	2448	734.50		4407				
3	WHITE	(4)	7.0	7.0	.500	817	2304	762.67		4576				
4	BLUE	(2)	5.0	9.0	.357	773	2162	655.33		3932				
=====														
NAME	ENT	#G	H-G	H-S	WOOD	AVE	NAME	ENT	#G	H-G	H-S	WOOD	AVE	
=====														
1 RED						=====	2 BLUE							
HARCOHE	140	6	110	330	642	107.0	GRANT	140	6	111	333	603	100.5	
SANDY	135	6	121	360	701	116.8	TORRE	135	6	120	342	642	107.0	
BROTHMAN	110	6	132	390	769	128.2	MILLAN	110	6	132	381	711	118.5	
JOELLY	170	6	211	538	958	159.7	BERRA	170	6	220	541	961	160.2	
SIMMON	180	6	181	542	992	165.3	MARTIN	180	6	190	565	1015	169.2	
3 GREEN						=====	4 WHITE							
MANTLE	140	5	131	393	584	116.8	HILL	140	6	150	416	806	134.3	
MORRIS	135	6	141	423	756	126.0	JORDON	135	6	143	426	755	125.8	
ROTH J	110	6	151	453	794	132.3	LIPSON C	110	6	160	456	858	143.0	
ROTH G	170	6	171	513	975	162.5	LIPSON L	170	6	233	603	1089	181.5	
LACEY	180	6	222	666	1188	198.0	KALIN	180	6	192	554	1068	178.0	
=====														
HIGH SCORES														
POS	NAME		AVE	NAME		H-S	NAME		H-G					
=====														
1	LIPSON C		143	LIPSON C		456	LIPSON C		160					
2	HILL		134	ROTH J		453	ROTH J		151					
3	ROTH J		132	JORDON		426	HILL		150					
=====														
1	LACEY		198	LACEY		666	LIPSON L		233					
2	LIPSON L		181	LIPSON L		603	LACEY		222					
3	KALIN		178	MARTIN		565	BERRA		220					

Fig. 1b.

the detailed design of the software, but will show the reader exactly how to use the programs presented.

The Software Package

The first program in the bowling package sets up the bowlers' names, averages, sex and status (discussed later), which must be entered on a disk. The programs can handle any combination of up to 210 bowlers playing on as many as 30 teams. To avoid hard-disk error, this information was entered on a disk by writing a nine-line program (excluding data) that uses the bowling information as data statements. Thus, the North Star BASIC edit functions can be used to enter data and execute the program over and over again after it is written until a disk is properly prepared. Listing 1 shows this program.

Variable Z in line 1 represents the teams (1 to 30); Z1 shows the number of players on each team (any number as


```

LANES 5 6      4 WHITE      1 RED      WEEK # 3

NAME  AVE = 1ST = 2ND = 3RD = TOT = NAME  AVE = 1ST = 2ND = 3RD = TOT
=====
HILL  -135 =    =    =    =    = HARCOHE -135 =    =    =    =    =
=====
JORDON -130 =    =    =    =    = SANDY  -130 =    =    =    =    =
=====
LIPSON C-143 =    =    =    =    = BROTHMAN-128 =    =    =    =    =
=====
LIPSON L-181 =    =    =    =    = JOELLY  -165 =    =    =    =    =
=====
KALIN  -178 =    =    =    =    = SIMMON -175 =    =    =    =    =
=====
=====
TOT.=    =    =    =    =    = TOT.=    =    =    =    =
=====
WON    HAND=    =    =    =    = -WON    HAND=    =    =    =    =
=====
LOST   TOT.=    =    =    =    = -LOST   TOT.=    =    =    =    =
=====

```

Fig. 1c.

```

LANES 1 2      1 TIGERS      2 LIONS      WEEK # 1

NAME  AVE = 1ST = 2ND = 3RD = TOT = NAME  AVE = 1ST = 2ND = 3RD = TOT
=====
SUE L.  -117 = 106 = 78 = 94 = 278 = ANGELA -110 = 116 = 114 = 74 = 304
=====
MAGGIE S-140 = 128 = 131 = 178 = 437 = RALPH S.-140 = 104 = 121 = 123 = 348
=====
FRANK P.-140 = 104 = 153 = 134 = 391 = RENEE L.-125 = 127 = 107 = 99 = 333
=====
BILL L.  -131 = 132 = 156 = 134 = 422 = JOHN  -123 = 113 = 113 = 113 = 339
=====
CHARLIE -144 = 139 = 106 = 128 = 373 = TED R.  -144 = 182 = 178 = 156 = 516
=====
672 =    =    =    =    =    = 642 = 642 = 633 = 565 =
=====
WON 1 HAND= 0 = 0 = 0 =    = -WON 3 HAND= 27 = 27 = 27
=====
LOST 5 TOT.= 609 = 624 = 668 =    = -LOST 1 TOT.= 669 = 660 = 592 =
=====

```

Fig. 4. Filled-in data-entry sheet.

```

FILE :MIX1
DATE :10/03/77
WEEK :2
LANES :1
ON LANE 1 ? 4
ON LANE 2 ? 6
ON LANE 3 ? 2
ON LANE 4 ? 5
ON LANE 5 ? 1
ON LANE 6 ? 3
4 6 2 5 1 30 TO FIX ? 4
SET ?

```

Fig. 3. Input for program run 1.

Data Entry

The data for this program includes the eight-character team name, followed by eight-character players' names coupled to a five-digit number. Lines 5000 to 5003 of Listing 1 show the data for team 1. The five-digit number corresponds to each bowler's average, sex and status. Therefore, the first bowler in line 5000 is "Sue L," who has a 11710 following her name. The number breaks down as follows: 117—bowling average; 1—sex is female (11700 would be a male with a 117 average); 0—status.

Fig. 2 shows how the above program, "Setup 1," runs. For the first execution, a 1 is entered to clear memory location 30470 to 32767, which will be used for the actual scores. A 0 is entered for the next run and

long as the number of players does not exceed 210). Variable Z2 is 2 for a mixed league (both male and female players) or 1 for a league with only one sex participating. Z3 represents the number of games required by a status 0 bowler to establish an average; Z4 applies to a status 1 bowler. This allows the flexibility to require established bowlers to bowl a certain number of games to get a revised

average, whereas a different number may be required for new bowlers. Variable Z5 sets the maximum number of pins for an established bowler to lower his average.

Note: Some of these variables are included in the bowling package to handle the more complex average calculations required by a few very sophisticated leagues that compete for high-prize money.

```

0 FOR NEW OR 1 TO CLEAR RAM: 1
READY
RUN

0 FOR NEW OR 1 TO CLEAR RAM: 0
FILE :MIX1
READY

```

Fig. 2. Initialization sequence.

```

FILE: MIX1
TEAM: 1
SUE L.   SCORES 106,78,94 278?
MAGGIE S SCORES 128,131,178 437?
FRANK P. SCORES 104,153,134 391?
BILL L.  SCORES 132,156,134 422?
CHARLIE  SCORES 139,106,128 373?
          SCORES 0,0,0 0?
HANDICAP 0,0,0 0?
BLIND    0,0,0 0?
        609 624 668 1901
WON-LOST 1,5 OK
OK TO UPDATE FILE ?
FILE UPDATED
TEAM: 2
ANGELA   SCORES 116,114,74 304?
RALPH S. SCORES 104,121,123 348?
RENEE L. SCORES 127,107,99 333?
JOHN     SCORES 0,0,0 0?
TED R.   SCORES 182,178,156 516?
          SCORES 0,0,0 0?
HANDICAP 27,27,27 81?
BLIND    113,113,113 339?
        669 660 592 1921
WON-LOST 5,1 OK
OK TO UPDATE FILE ?
FILE UPDATED
TEAM: 0
READY

```

Fig. 5. Entering data from data-entry sheets (provided by various teams).

the computer asks for a file name. MIX 1 is entered and all the names are written in this disk file.

The main program, called RUN 1 (Listing 2), can now be executed. Fig. 3 shows how this program runs. It asks for the file location of the bowlers' names, the date, the week (1 for first week of bowling, 2 for second, etc.), the league lanes and which team is on each lane. The program prints the lane assignments; an input of 0 lets you change them in case of error. Finally, the program asks "set ?" which allows you to set your paper to line one and push carriage return. Fig. 6 is the print-out which follows.

Fig. 3 gives the inputs for week 2. For the first run, you should enter 1 for the week and the computer will generate all blank forms. The blank forms are supplied to the bowling center as input sheets to be used. Fig. 4 shows how this blank form is filled out by the bowlers. The completed form is collected by the center and returned to you for processing.

Listing 3 is the input program—INPUT 1. Fig. 5 shows the data from Fig. 4 being entered into the computer. The program asks for the file name and then the team number. The computer then prints the name of each bowler. Enter the three scores and press return; a total is

NYAC MIXED

10/03/77

POS	TEAM	WON	LOST	WIN - LOSS PERCENTAGE	HIGH GAME	HIGH SERIES	AVERAGE	TOTAL WOOD
1	LIONS (2)	5.0	1.0	.833	669	1921	640.33	1921
2	BEARS (3)	5.0	1.0	.833	694	1995	665.00	1995
3	ROBBERS (6)	5.0	1.0	.833	732	2053	684.33	2053
4	TIGERS-- (1)	1.0	5.0	.167	668	1901	633.67	1901
5	LANCERS (4)	1.0	5.0	.167	693	1974	658.00	1974
6	MAN'TANS (5)	1.0	5.0	.167	614	1841	613.67	1841

NAME	ENT	#G	H-G	H-S	WOOD	AVE	NAME	ENT	#G	H-G	H-S	WOOD	AVE
1 TIGERS--													
SUE L.	117	3	106	278	278	92.7	ANGELA	110	3	116	304	304	101.3
MAGGIE S	140	3	178	437	437	145.7	RALPH S.	140	3	123	348	348	116.0
FRANK P.	140	3	153	391	391	130.3	RENEE L.	125	3	127	333	333	111.0
BILL L.	131	3	156	422	422	140.7	JOHN	123	0	0	0	0	.0
CHARLIE	144	3	139	373	373	124.3	TED R.	144	3	182	516	516	172.0
	0	0	0	0	0	.0		0	0	0	0	0	.0
3 BEARS													
MRS. D	110	0	0	0	0	.0	MRS. H.	110	0	0	0	0	.0
RENEE B.	120	0	0	0	0	.0	NELSON H	140	0	0	0	0	.0
SANDY	106	3	138	347	347	115.7	PAT R.	119	0	0	0	0	.0
BILL D	140	0	0	0	0	.0	ELSIE	110	3	125	286	286	95.3
CHUCK R	154	3	204	496	496	165.3	JOE R.	167	3	226	581	581	193.7
	0	0	0	0	0	.0		0	0	0	0	0	.0
5 MAN'TANS													
CAROL	103	3	112	291	291	97.0	POLLY	110	3	163	391	391	130.3
EILEEN	120	3	128	307	307	102.3	PAT J.	105	3	128	347	347	115.7
KATHY M.	141	0	0	0	0	.0	JOE W.	111	3	140	356	356	118.7
BLIND	140	0	0	0	0	.0	JOE C.	144	0	0	0	0	.0
PAUL S.	155	3	144	400	400	133.3	RICHIE M	155	3	181	437	437	145.7
	0	0	0	0	0	.0		0	0	0	0	0	.0

HIGH SCORES						
POS	NAME	AVE	NAME	H-S	NAME	H-G
1	JOE R.	193	JOE R.	581	JOE R.	226
2	TED R.	172	TED R.	516	CHUCK R	204
3	CHUCK R	165	CHUCK R	496	TED R.	182
1	MAGGIE S	145	MAGGIE S	437	MAGGIE S	178
2	POLLY	130	POLLY	391	POLLY	163
3	PAT J.	115	SANDY	347	SANDY	138

Fig. 6. The finished product.

LANES 5 6					1 TIGERS--					3 BEARS					WEEK # 2				
NAME	AVE	=	1ST	=	2ND	=	3RD	=	TOT	NAME	AVE	=	1ST	=	2ND	=	3RD	=	TOT
SUE L.	- 92	=		=		=		=		MRS. D	-110	=		=		=		=	
MAGGIE S	-145	=		=		=		=		RENEE B.	-120	=		=		=		=	
FRANK P.	-130	=		=		=		=		SANDY	-115	=		=		=		=	
BILL L.	-140	=		=		=		=		BILL D	-140	=		=		=		=	
CHARLIE	-124	=		=		=		=		CHUCK R	-165	=		=		=		=	
	- 0	=		=		=		=			- 0	=		=		=		=	
	631	=		=		=		=			650	=		=		=		=	
WON	HAND=	17	=	17	=	17	=			-WON	HAND=	0	=	0	=	0	=		
LOST	TOT.=		=		=		=			-LOST	TOT.=		=		=		=		

Fig. 7. Updated data-entry form for distribution to team.

printed by the computer for verification. This avoids input errors, since the total should agree with the input sheet.

To go to the next bowler push carriage return. Any character except a carriage return will cause the computer to ask for the same bowler's scores again. This allows for the immediate correction of errors.

Note that after Charlie in Fig. 5, scores are still solicited by the computer. This is done because an extra player was put on each team to provide for possible expansion. Next, the computer asks for the handicaps and, finally, for blind scores—scores not actually bowled but assigned to absent-


```

BYE
*LI
DOS      4    10    0
B        14   40   2A00
SETUP1   54   24   2
SETUP2   78   24   2
SETUP3  102   24   2
INPUT1   126  24   2
INPUT2   150  24   2
INPUT3   174  24   2
RUN1     198  24   2
RUN2     222  24   2
RUN3     246  24   2
DATA1    300  10   3
DATA2    270  10   3
MIX1     280  10   3
MIX2     290  10   3
*SF DATA1 7706
*SF DATA2 7706
*GO B

READY
PRINT FREE(0)
9105
READY

```

Fig. 8. Bowling-package directory.

asks for the won and lost points, which are supplied by the bowlers on the input sheet.

A carriage return after OK TO UPDATE FILE? enters the data; anything else erases all the input. A carriage return signifies your approval of each individual input line; anything else allows for the re-input of the line. Team 0 ends the input program. All input need not be done at the same time. However, before the machine is turned off the scores must be saved by copying memory locations 30470 to 32767 to a file. With the North Star Disk System, this is done by:

```

BYE
SF DATA1 7706

```

This assumes file DATA 1 was created. The 7706 is hex for the start of the memory locations to be saved.

Fig. 6 shows the finished product generated by program RUN 1 (Listing 2). Fig. 3 describes the input required for this run. Fig. 7 shows a new blank input form generated by

RUN 1. The averages have been updated; a comparison of Team 1's averages to those shown in Fig. 4 illustrates how they've changed. A spelling correction and team names were also added by editing program SETUP 1 and running it again.

Fig. 8 shows the table of contents for my bowling package disk—three copies of each program and two of the data. In this figure, North Star BASIC is referred to as B. My system has 24K placed in addresses 8192 to 32767. Address 2A0A (hex) was changed to 76 (hex) to use addresses 30470 to 32767 for fill and examine instructions. Therefore, GO B and Print Free (0) yield 9105 bytes.

Wrap-up

Good luck with this application. Just remember to concentrate on marketing and maybe add some new features to these programs to attain an edge. I have several leagues enrolled now and plan to improve my service. Maybe we will be in competition. ■

Listing 1. Initial data-base generation.

```

1 Z=6:Z1=6:Z2=2:Z3=3:Z4=0:Z5=0
2 INPUT "O FOR NEW OR 1 TO CLEAR RAM: ",A:IFA=1 THEN Z00
3 IFA<0 THEN END INPUT:FILE : ".F$ \OPEN#0.F$
4 DIM A$(8)
5 A$=""
6 FOR A=0 TO Z1:Z2:Z3:Z4:Z5
7   FOR A=1 TO Z0:READ A$:WRITE#0,A$:FORB=1 TO Z1:READ A$,C
8   WRITE#0,A$,C:NEXT B:NEXT A
9
10
11
12

```

```

290 !TAB(12),Z21,D," ",N1$(V1,V2),TAB(37),"===",TAB(52),Z21,D+1," ",
292 IN1$(V3,V4)
300 FORG=1 TO Z1\FORG=0 TO Z1\F=0:V1=((F-1)*Z1)+G
310 V2=((V1-1)*6)+B+V4=V1*8+V3-V4-7*V5=EXAM(V2+1)+45
320 Q1=EXAM(V2+2)\Q2=EXAM(V2+3)\GOSUB1000\Q3=Q1\Q4=INT(A(V1)/100)
325 IFV6=45 THEN V6=0
330 Q1=EXAM(V2+4)\Q2=EXAM(V2+5)\GOSUB1000\Q3=Q1\Q4=INT(A(V1)/100)
335 V8=Q1/V5
340 IN$(V3,V4),Z41,V9,V5,V6,V7,Z61,Q1,Z6F1,V8,\GOSUB1300
345 GOSUB1460
350 IFE=0 THEN ! "===",NEXT V1:"NEXT V2:"NEXT V3:"NEXT V4:"NEXT V5:"NEXT V6:"NEXT V7:"NEXT V8:"NEXT V9:"NEXT V10:"NEXT V11:"NEXT V12:"NEXT V13:"NEXT V14:"NEXT V15:"NEXT V16:"NEXT V17:"NEXT V18:"NEXT V19:"NEXT V20:"NEXT V21:"NEXT V22:"NEXT V23:"NEXT V24:"NEXT V25:"NEXT V26:"NEXT V27:"NEXT V28:"NEXT V29:"NEXT V30:"NEXT V31:"NEXT V32:"NEXT V33:"NEXT V34:"NEXT V35:"NEXT V36:"NEXT V37:"NEXT V38:"NEXT V39:"NEXT V40:"NEXT V41:"NEXT V42:"NEXT V43:"NEXT V44:"NEXT V45:"NEXT V46:"NEXT V47:"NEXT V48:"NEXT V49:"NEXT V50:"NEXT V51:"NEXT V52:"NEXT V53:"NEXT V54:"NEXT V55:"NEXT V56:"NEXT V57:"NEXT V58:"NEXT V59:"NEXT V60:"NEXT V61:"NEXT V62:"NEXT V63:"NEXT V64:"NEXT V65:"NEXT V66:"NEXT V67:"NEXT V68:"NEXT V69:"NEXT V70:"NEXT V71:"NEXT V72:"NEXT V73:"NEXT V74:"NEXT V75:"NEXT V76:"NEXT V77:"NEXT V78:"NEXT V79:"NEXT V80:"NEXT V81:"NEXT V82:"NEXT V83:"NEXT V84:"NEXT V85:"NEXT V86:"NEXT V87:"NEXT V88:"NEXT V89:"NEXT V90:"NEXT V91:"NEXT V92:"NEXT V93:"NEXT V94:"NEXT V95:"NEXT V96:"NEXT V97:"NEXT V98:"NEXT V99:"NEXT V100:"NEXT V101:"NEXT V102:"NEXT V103:"NEXT V104:"NEXT V105:"NEXT V106:"NEXT V107:"NEXT V108:"NEXT V109:"NEXT V110:"NEXT V111:"NEXT V112:"NEXT V113:"NEXT V114:"NEXT V115:"NEXT V116:"NEXT V117:"NEXT V118:"NEXT V119:"NEXT V120:"NEXT V121:"NEXT V122:"NEXT V123:"NEXT V124:"NEXT V125:"NEXT V126:"NEXT V127:"NEXT V128:"NEXT V129:"NEXT V130:"NEXT V131:"NEXT V132:"NEXT V133:"NEXT V134:"NEXT V135:"NEXT V136:"NEXT V137:"NEXT V138:"NEXT V139:"NEXT V140:"NEXT V141:"NEXT V142:"NEXT V143:"NEXT V144:"NEXT V145:"NEXT V146:"NEXT V147:"NEXT V148:"NEXT V149:"NEXT V150:"NEXT V151:"NEXT V152:"NEXT V153:"NEXT V154:"NEXT V155:"NEXT V156:"NEXT V157:"NEXT V158:"NEXT V159:"NEXT V160:"NEXT V161:"NEXT V162:"NEXT V163:"NEXT V164:"NEXT V165:"NEXT V166:"NEXT V167:"NEXT V168:"NEXT V169:"NEXT V170:"NEXT V171:"NEXT V172:"NEXT V173:"NEXT V174:"NEXT V175:"NEXT V176:"NEXT V177:"NEXT V178:"NEXT V179:"NEXT V180:"NEXT V181:"NEXT V182:"NEXT V183:"NEXT V184:"NEXT V185:"NEXT V186:"NEXT V187:"NEXT V188:"NEXT V189:"NEXT V190:"NEXT V191:"NEXT V192:"NEXT V193:"NEXT V194:"NEXT V195:"NEXT V196:"NEXT V197:"NEXT V198:"NEXT V199:"NEXT V200:"NEXT V201:"NEXT V202:"NEXT V203:"NEXT V204:"NEXT V205:"NEXT V206:"NEXT V207:"NEXT V208:"NEXT V209:"NEXT V210:"NEXT V211:"NEXT V212:"NEXT V213:"NEXT V214:"NEXT V215:"NEXT V216:"NEXT V217:"NEXT V218:"NEXT V219:"NEXT V220:"NEXT V221:"NEXT V222:"NEXT V223:"NEXT V224:"NEXT V225:"NEXT V226:"NEXT V227:"NEXT V228:"NEXT V229:"NEXT V230:"NEXT V231:"NEXT V232:"NEXT V233:"NEXT V234:"NEXT V235:"NEXT V236:"NEXT V237:"NEXT V238:"NEXT V239:"NEXT V240:"NEXT V241:"NEXT V242:"NEXT V243:"NEXT V244:"NEXT V245:"NEXT V246:"NEXT V247:"NEXT V248:"NEXT V249:"NEXT V250:"NEXT V251:"NEXT V252:"NEXT V253:"NEXT V254:"NEXT V255:"NEXT V256:"NEXT V257:"NEXT V258:"NEXT V259:"NEXT V260:"NEXT V261:"NEXT V262:"NEXT V263:"NEXT V264:"NEXT V265:"NEXT V266:"NEXT V267:"NEXT V268:"NEXT V269:"NEXT V270:"NEXT V271:"NEXT V272:"NEXT V273:"NEXT V274:"NEXT V275:"NEXT V276:"NEXT V277:"NEXT V278:"NEXT V279:"NEXT V280:"NEXT V281:"NEXT 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V1673:"NEXT V1674:"NEXT V1675:"NEXT V1676:"NEXT V1677:"NEXT V1678:"NEXT V1679:"NEXT V1680:"NEXT V1681:"NEXT V168
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```

130 CLOSE#0\END
200 FORA=30470\TO32767\FILLA,B\NEXT\END
5000 DATA"-----","SUE L. ",11710,"MAGGIE S",14010,"FRANK P.",14000
5002 DATA"BILL L. ",13100,"CHARLIE ",14400
5003 DATA" ",00000
5004 DATA"-----","ANGELA ",11010,"RALPH S.",14000,"RENEE L.",12510
5006 DATA"JOHN ",12300,"TED R. ",14400
5007 DATA" ",00000
5008 DATA"-----","MRS. D ",11010,"RENEE B.",12010,"SANDY ",10610
5010 DATA"BILL D ",14000,"CHUCK R ",15400
5011 DATA" ",00000
5012 DATA"-----","MRS. H. ",11010,"NELSON H",14000,"PAT R. ",11910
5014 DATA"ELSIE ",11010,"JOE R. ",16700
5015 DATA" ",00000
5016 DATA"MAN'TANS","CAROL ",10310,"EILEEN ",12010,"KATHY M.",14110
5018 DATA"BLIND ",14000,"PAUL S. ",15500
5019 DATA" ",00000
5020 DATA"-----","BLIND ",11010,"PAT J. ",10510,"JOE W. ",11100
5022 DATA"JOE C. ",14400,"RIICHIE M",15500
5023 DATA" ",00000
READY

```

Listing 2. The main program (called RUN 1).

```

1 DIMN1$(240),N$(1680),P(2,30),H(1,2,2),N2$(8),A(210),A$(20)
3 LINE 80
5 INPUT"FILE :",F$,OPEN#0,F$
6 READ#0,Z,Z1,Z2,Z3,Z4,Z5\FORA=1TOZ\READ#0,N2$,V2=A*8
8 N1$(V2-7,V2)=N2$\FORB=1TOZ1\READ#0,N2$,C\D=((A-1)*Z1)+B
10 V2=8*D\N$(V2-7,V2)=N2$\A(D)=C\NEXT\NEXT
12 A$=""
14 B$="-----"C$=""
15 A$(1,10)="NYAC MIXED" \INPUT"DATE :",A$(11,20)\INPUT"WEEK :",Z6
16 INPUT"LANES :",Z7
17 FORD=1TOZ!\ON LANE",D,\INPUT" ? ",P(2,D)\NEXT
18 FORD=1TOZ!\P(2,D),\NEXT\INPUT"0 TO FIX ? ",E\IFE=0THEN17
20 A=30470\B=30800\C=32060
30 FORD=1TOZ\F(0,D)=D\Q1=A+(11*(D-1))\Q2=EXAM(Q1+1)\Q1=EXAM(Q1)
40 GOSUB1000\F(1,D)=Q1\NEXT
50 Q1=0\FORD=2TOZ\IFF(1,D-1)>=P(1,D)THEN80
60 Q2=P(1,D-1)\Q3=P(0,D-1)\P(1,D-1)=P(1,D)\P(0,D-1)=P(0,D)
70 P(1,D)=Q2\P(0,D)=Q3\Q1=10
80 NEXT\IFQ1>0THEN50
95 G=(Z6-1)*3\INPUT"SET ? ",Z$
100 !TAB(30),A$(1,10),TAB(60),A$(11,20)\!TAB(30),"=====!\!"
138 !TAB(33),"WIN - LOSS HIGH HIGH TOTAL"
140 !"POS TEAM WON LOST PERCENTAGE GAME SERIES",
150 !" AVERAGE WOOD"GOSUB1040
170 FORD=1TOZ\A=P(0,D)\V2=8*E\V1=V2-7\V3=2+A+((E-1)*11)\Q1=EXAM(V3)
180 Q2=EXAM(V3+1)\GOSUB1000\V4=Q1\IFF(1,D)+V4<1THEN190
185 V5=P(1,D)/(P(1,D)+V4)
190 Q1=EXAM(V3+2)\Q2=EXAM(V3+3)\GOSUB1000\V6=Q1
200 Q1=EXAM(V3+4)\Q2=EXAM(V3+5)\GOSUB1000\V7=Q1
210 Q1=EXAM(V3+6)\Q2=EXAM(V3+7)\Q3=EXAM(V3+8)\GOSUB1000
215 IFQ3ORG=0THEN225
220 V9=Q1+(Q3*65536)\V8=V9/G
225 P(1,D)=P(1,D)*.1\V4=V4*.1
230 !Z3I,D," ",N1$(V1,V2)," (" ,Z2I,E," ),Z7F1,P(1,D),
240 !Z7F1,V4,Z9F3,V5," ",Z6I,V6,Z8I,V7,Z9F2,V8,Z10I,V9
250 NEXT\A=6+Z\IF64>L+4+1+Z1THEN270
260 D=66-L\FOR=1TOD!\NEXT\L=0
270 GOSUB1110\L=4\L1=2+Z1
280 FORD=1TOZSTEP2\V2=D*8\V1=V2-7\V3=V1+8\V4=V2+8

```

```

1600 !A$,C$,B$,C$,B$,C$,B$,C$,B$,C$,"-",
1610 !A$,C$,B$,C$,B$,C$,B$,C$,B$,C$\RETURN
1620 RETURN
1630 A$="-----"B$="-----"RETURN
1700 ! C$,B$,C$,B$,C$,B$,C$,B$,C$,"-",
1705 RETURN
1710 ! C$,B$,C$,B$,C$,B$,C$,B$,C$\RETURN
READY

```

Listing 3. The data-entry program.

```

10 DIMN$(1680),A$(8),S(10,6)
15 F1=30470\F2=30800
20 INPUT"FILE :",F$,OPEN#0,F$
30 READ#0,Z,Z1,Z2,Z3,Z4,Z5\W=Z1+2
40 FORA=1TOZ\READ#0,A$\FORB=1TOZ1\READ#0,A$,C
50 D=((A-1)*Z1)+B\D=D*8\N$(D-7,D)=A$\NEXT\NEXT
55 FORA=0TOW\FORB=0TOS\A(B)=0\NEXT\NEXT
60 INPUT"TEAM: ",A\FORB=1TOZ1\D=((A-1)*Z1)+B
65 IFA<10RA>ZTHENEND\D=D*8
70 !N$(D-7,D),\INPUT"1" SCORES ",S(B,1),S(B,2),S(B,3)
75 S(B,4)=S(B,1)+S(B,2)+S(B,3)
80 !Z6I,S(B,4),\INPUTZ$\IFZ$=""THEN90\GOTO70
90 NEXT
100 INPUT1"HANDICAP ",S(W,1),S(W,2),S(W,3)\S(W,4)=S(W,1)+S(W,2)+S(W,3)
110 !Z6I,S(W,4),\INPUTZ$\IFZ$=""THEN112\GOTO100
112 INPUT1"BLIND ",S(W-1,1),S(W-1,2),S(W-1,3)
114 S(W-1,4)=S(W-1,1)+S(W-1,2)+S(W-1,3)
116 !Z6I,S(W-1,4),\INPUTZ$\IFZ$=""THEN120\GOTO112
120 FORB=1TOW\FORC=1TO4\S(0,C)=S(0,C)+S(B,C)
125 IFC=4THEN150
130 IFS(B,C)>0THENS(B,0)=S(B,0)+1
140 IFS(B,C)>S(B,5)THENS(B,5)=S(B,C)
150 NEXT\NEXT
152 FORB=1TO3\IFS(0,B)>S(0,5)THENS(0,5)=S(0,B)\NEXT
160 FORC=1TO4\!Z8I,S(0,C),\NEXT\!"
162 INPUT1"WON-LOST ",W1,W2\INPUT" OK",Z$
164 IFZ$=""THEN170\GOTO162
170 INPUT"OK TO UPDATE FILE ? ",Z$\IFZ$=""THEN180\GOTO55
180 S(0,0)=W1*10\S(0,2)=W2*10\S(0,6)=S(0,4)\S(0,4)=S(0,5)
190 F3=F1+((A-1)*11)\FORB=0TOSSTEP2\C=F3+B\D=F3+B+1
200 L=EXAM(C)\M=EXAM(D)\GOSUB1000
210 IFB>3THEN250
220 N=N+S(0,B)\GOSUB2000\FILLC,L\FILLD,M\GOTO300
250 IFN>S(0,B)THEN300\N=S(0,B)\GOSUB2000
260 FILLC,L\FILLD,M
300 NEXT
310 L=EXAM(F3+8)\M=EXAM(F3+9)\O=EXAM(F3+10)\GOSUB1000
320 N=N+(65536*O)+S(0,6)\O=INT(N/65536)
330 N=N-(O*65536)\GOSUB2000
340 FILLF3+8,L\FILLF3+9,M\FILLF3+10,O
400 F3=((A-1)*Z1*6)+F2\FORB=1TOZ1\F4=((B-1)*6)+F3
410 L=EXAM(F4)\L=L+S(B,0)\FILLF4,L\N=S(B,5)-45
420 L=EXAM(F4+1)\IFL>NTHEN430\FILLF4+1,N
430 L=EXAM(F4+2)\M=EXAM(F4+3)\GOSUB1000
440 IFN>S(B,4)THEN460\N=S(B,4)\GOSUB2000
450 FILLF4+2,L\FILLF4+3,M
460 L=EXAM(F4+4)\M=EXAM(F4+5)\GOSUB1000\N=N+S(B,4)
470 GOSUB2000\FILLF4+4,L\FILLF4+5,M
480 NEXT\!"FILE UPDATED"\GOTO55
1000 N=L+(256*M)\RETURN
2000 M=INT(N/256)\L=N-(256*M)\RETURN
READY

```


It's Here: Machine Language for the TRS-80

A description of a new monitor program from Radio Shack for the TRS-80.

Tired of playing blackjack with your TRS-80? Want to get down to serious business? If so, you've probably found that Radio Shack's 4K BASIC keeps you insulated from most of the Z-80's impressive capabilities. Wouldn't it be nice if there were some way to get out of BASIC and into the guts of the machine? Well, there is!

Radio Shack is now offering T-BUG, a 1K monitor program that permits you to use your TRS-80 as a *limited* development system. I have been playing with a copy for about a month now, and can report that it adds a whole new dimension to the usefulness of the machine.

Though I say limited, there is really no limit to what you can do with enough perseverance. However, it is only a 1K monitor, and as such, is roughly comparable to the 6800 MIK-BUG, or similar programs. I wouldn't want to develop a compiler with it, but it does open all kinds of doors most of us thought were closed.

T-BUG comes on a cassette and loads like any ordinary tape, using CLOAD. There's one profound difference—when the tape load is finished, you don't get the expected READY. Instead, you get a #, which tells you that you're free from BASIC!

How does this happen? As near as I can tell, each tape has a leader block, which not only contains the usual information, such as the load address and length of record, but also the

address at which execution is to begin. For all tapes generated by BASIC, this address is 0000, and thus has the same effect as a reset. On the T-BUG

tape, the address is the first instruction of T-BUG, which gets you going.

Now, without going any further into the details of the moni-

tor, we already have some intriguing possibilities—such as writing our own tapes with custom operating systems for special uses, or building a black box which simulates the input of that leader data.

I suppose I knew that there had to be some kind of system like this... how else could Radio Shack provide the assembler/editor tapes? Still, it's nice to know how to do it yourself. No, you can't write tapes with your own start address from T-BUG... it always starts at its own entry; but now you can get into the machine and make it do things your way!

Note that the CRT display occupies address space. The CRT video generation is totally transparent to the CPU. Just store an ASCII character in a location, and it's displayed. Incidentally, the arrows on the four cursor control keys are displayable as codes 5B through 5E. 5F is the cursor (_).

Note also that the keyboard occupies 256 bytes of address space, and a lot more if you count the unused space around it. This may seem wasteful, but, in my opinion, is the cleverest feature of the whole computer. We have all seen systems with a matrix-type keyboard. Typically, you put out an 8-bit word to an output port, which is latched and strobes the rows of the matrix. The columns are then read into an input port.

Radio Shack has reduced this concept to its bare essentials: There are no ports... the keyboard ties right across the

M nnnn	Displays the contents of location nnnn in hex. If you wish to alter the contents, merely enter the new data. The monitor will then display the next location, etc. To skip to the next location without entering new data, press ENTER.
X	Gets you out of the M mode. It also is used to abort other commands, such as when you type the wrong value for an address.
B nnnn	Sets a breakpoint at location nnnn. When control reaches this location, it will revert back to the monitor. The manual says only one breakpoint can be set at once. This is not strictly true... you can set as many as you want, but the monitor will only remember the last one.
F	Removes a previously set breakpoint. This is where the remembering comes in!
R	Displays the contents of the registers. All registers, including the program counter, stack pointer and index registers are displayed. The contents of these registers cannot be altered directly using R. However, it can be done if you need to.
P nnnn mmmm	Writes the contents of locations nnnn through mmmm to the cassette.
L	Loads a program from cassette. The program loads into the same locations it was written from.

When I got my copy of T-BUG, the first thing I set out to do was to explore the memory space of the computer. As a result, I was able to draw the memory map shown below:

0000-0FFF	4K BASIC monitor.
1000-2FFF	Empty ROM sockets for remaining 8K.
2000-37FF	Unused. (Usable???)
3800-3880	Keyboard.
3881-3BFF	Unused.
3C00-3FFF	CRT display RAM.
4000-7FFF	User RAM.
8000-FFFF	Expansion.

Table 1. T-BUG instructions.

address and data lines. When the keyboard is enabled by a high byte of 38, the low byte serves to strobe the matrix. Only one line of this byte can be high at one time, which explains why the keyboard takes up so much room. Only the addresses 3801, 3802, 3804, 3808, 3810, 3820, 3840 and 3880 are actually used.

Now, here's the great part: When an address line is high and a key in that row is depressed, the key ties the address and data lines together! This drives a data line high, and it is read as a byte with one high bit. In other words, to the CPU, the keyboard looks just like any other RAM. In this case, there is

Low Addr →	01	02	04	08	10	20	40	80
Data	01	@	H	P	X	0	8	cr
↓	02	A	I	Q	Y	1	9	clr
	04	B	J	R	Z	2	:	brk
	08	C	K	S		3	;	↑
	10	D	L	T		4	,	↓
	20	E	M	U		5	-	←
	40	F	N	V		6	.	→
	80	G	O	W		7	/	b

Fig. 1. Keyboard organization.

a considerable software overhead for decoding.

However, RS wisely made the right choices as to where to allocate software and hardware—use software where speed is not an issue (keyboard) and hardware where it is

(CRT). The organization of the keyboard is laid out in Fig. 1.

There are a few noteworthy points about this organization. First, the keys are essentially sequential in their ASCII order, so decoding is reasonably straightforward. Second, the

shift key is in a column by itself, so it can be used with any other key. I repeat . . . any other key, so if you wish you had not only lowercase, but also more special keys, you can get them. Would you believe shift-space bar? Finally, if you *really* want them, there's room in the matrix, if not on the keyboard, for five more keys.

As you can see, I've been having a lot of fun with T-BUG so far; and I've hardly begun to write software! It is a fairly limited monitor, in keeping with its size. If I had written it, I probably would have done things a little differently. And since I now have the capability, that's what I'm doing! ■

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Two Systems Sharing the Same Bus

Distributed computing comes to microcomputers with this clever I/O system.

I believe this article is a first in computer-hobbyist publications. I don't recall ever seeing an article on interfacing two microcomputers. The technique is rather widespread in the world of the mainframes . . . but I suspect Mark is only one of a handful of people who have done it with personal systems.
—John.

Many computer hobbyists have experienced (or will someday) the ultimate frustra-

tion: a full bus. To the experimenter (with good financing) who delights in adding new gadgets to his computer system, a full bus means that new boards can no longer be plugged in with impunity. Now a decision must be made. Which old board will be removed to make room for the latest board?

One alternative to this horrible situation is to buy a new computer for the new boards.

Of course, all those neat boards in the old computer can't be used in both computers simultaneously, and a great deal of duplication becomes necessary. A better alternative is to expand the bus of the original computer onto a second bus with its own cabinet, power supply, etc. This solution allows simultaneous use of all the boards, but it is almost as expensive as buying a second computer.

Why not have the best of both alternatives? Extend your computer's bus by interfacing it to another microcomputer! This really isn't as difficult as it sounds, and it gives you the choice of either two independent computers or one larger computer. The two computers don't even have to be the same type, although things get more complicated with different CPUs. This article describes an interface between two different microcomputers that use the Motorola 6800 CPU, but the same basic ideas could be used to interface any two microcomputers.

Overview

I interfaced my two comput-

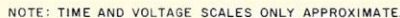
ers in an arrangement that allows either fully independent operation or master-slave operation. In the master-slave mode, the master computer takes over the slave-computer's bus and uses the slave's memory and I/O just as if they were on the master's bus. The mode of operation is under software control by the master computer.

My master computer is a Wave Mate Jupiter II. This is a nicely designed and executed system with many useful features. My expansion bus (the slave microcomputer), which doesn't need all the features of the master computer, is an SWTP 6800. Since both computers employ the 6800 CPU chip, much of the software I use with the Wave Mate (WM) can be modified to run on the SWTP. Moreover, the interface between two buses designed for the same CPU chip is only slightly more complicated than an interface between two identical buses.

The SWTP is almost ideal as a slave microcomputer—it is inexpensive, has a wide range of I/O available and is simple and easy to modify for DMA (di-



My two-computer system. The SWTP part of the interface can be seen in the last SWTP slot. The two interface cables run from this board, through separate openings in the back panel, down to the WM part of the interface.



equivalent capacitance must be charged by the driver. To change it from high to low, this same capacitance must be discharged. The resistance and inductance in the line, as well as the output current capabilities of the driver, determine the rate at which the line can be charged or discharged. For high-current drivers (e.g., 8T26s), and moderate lengths of cable, the time constant for charging or discharging a line is a few nanoseconds (ns) or less.

Microcomputer bus lines do not need to change state in ns. Typical allowed setup times for bus lines on the 6800, using a 1 MHz clock, are 150 to 200 ns. Since noise problems increase with increasing rates of change on the bus lines, it makes sense to slow the lines down to the

rate needed by the computer system.

Current-limiting resistors can be connected between the drivers and ribbon-cable conductors to limit the rate lines can be charged or discharged. The receivers I used require less than .2 mA of current flow in the ribbon cable for proper switching. This means that if a .5 volt drop is the maximum allowed across the resistor, the resistor could be as large as 2.5k.

Since typical ribbon cable has an interwire capacitance of 10 to 20 pF per foot, the capacitance seen by the drivers will be on the order of 20 pF. A 1k resistor in series with a 20 pF capacitor will allow the capacitor to charge to 98 percent of any voltage applied across the combination in less than 100

ns. This should not interfere with the normal operation of a microcomputer that uses a 6800 CPU chip, but it will significantly reduce noise problems in the ribbon cable. In my design, with approximately 18 inches of ribbon cable, I use 470 Ohm resistors at the driver end of all unidirectional lines and at both ends of the bidirectional lines.

The three methods above reduce the noise produced in the bus lines, but it is also worthwhile to reduce the sensitivity of the phase 1 lines to noise. Since we are using a driver-receiver scheme, we can use receivers that have a high noise immunity. TTL Schmitt trigger input inverters are ideal for this purpose.

The TTL Schmitt trigger has a different switching threshold

when its input is going high than when its input is going low. For the output to switch low, the input must exceed approximately 1.7 volts. Once the output has switched low, the input must go below approximately .8 volts to switch the output high again. Unlike normal TTL inputs, Schmitt trigger inputs have no disallowed range between low and high. These hysteresis characteristics give the Schmitt trigger inputs much greater noise immunity than regular TTL inputs.

The Circuitry

Now let's look at the Wave Mate to SWTP interface design. The schematics for the two parts of the interface are given in Figs. 2 and 3. Fig. 2 shows the logic located in the WM and Fig. 3 illustrates the logic in the SWTP. The two connecting cables are denoted by Con (the 26-conductor cable) and S (the 16-conductor cable). I haven't shown the ground connections (every even-numbered line in S) or the repeated circuitry in the address lines and data lines.

Most of the logic to convert the WM bus signals to the SWTP bus signals is located in the SWTP. This is because only half of a WM board was available for use in the interface. In any case, it makes sense to put as much interface as possible in the slave computer where it will use power only when the slave is in use.

In addition to reducing noise problems, the driver, current-limiting resistor, receiver design also allows simple circuitry for independent use of the computers. When one computer is unpowered, the current-limiting resistors prevent excessive current flow from the drivers in the other computer. For fully independent operation of the two computers with the interface, 2k pull-down resistors were installed on four of the 74LS14 inputs on the WM board and one on the SWTP board. These resistors prevent the interface from interfering with the operation of either computer when the other computer is not powered or the interconnecting cables are dis-

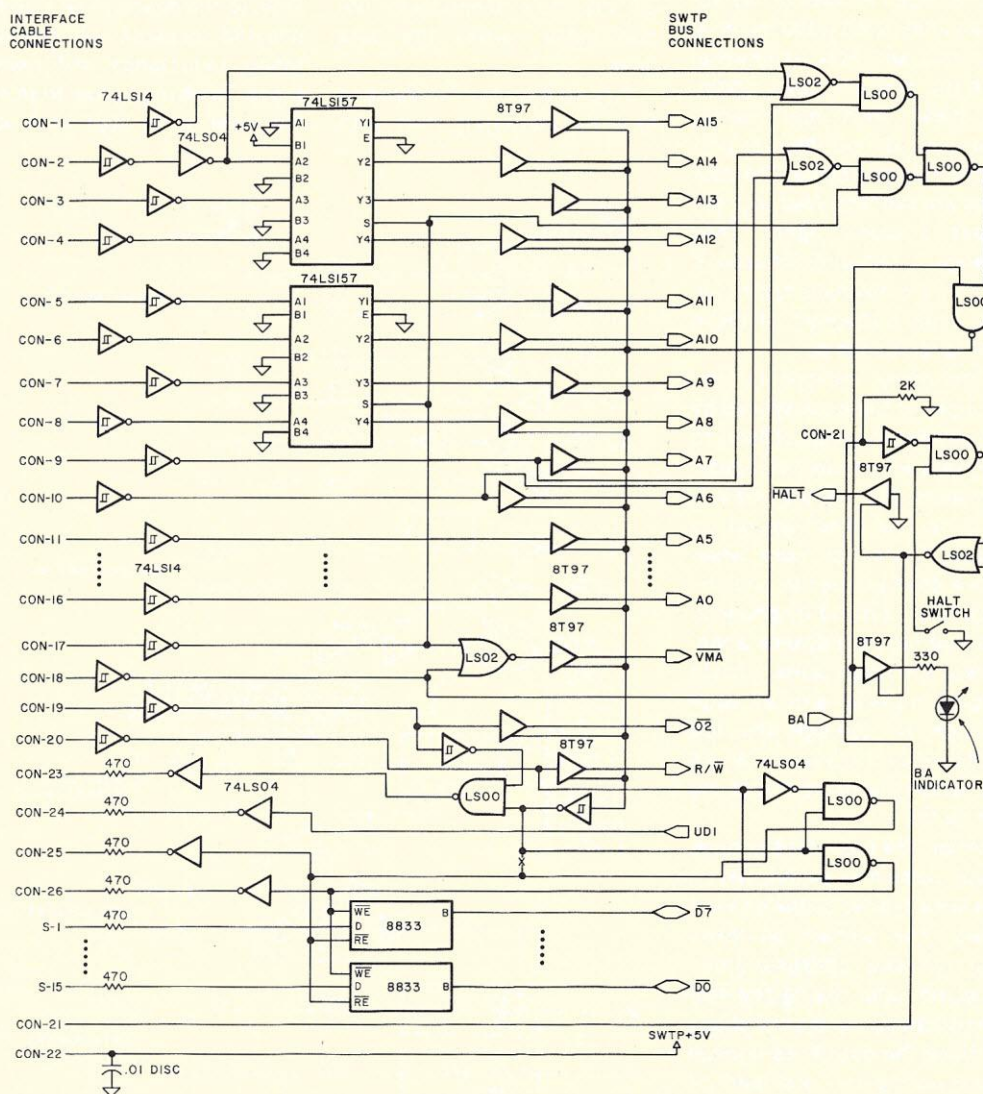
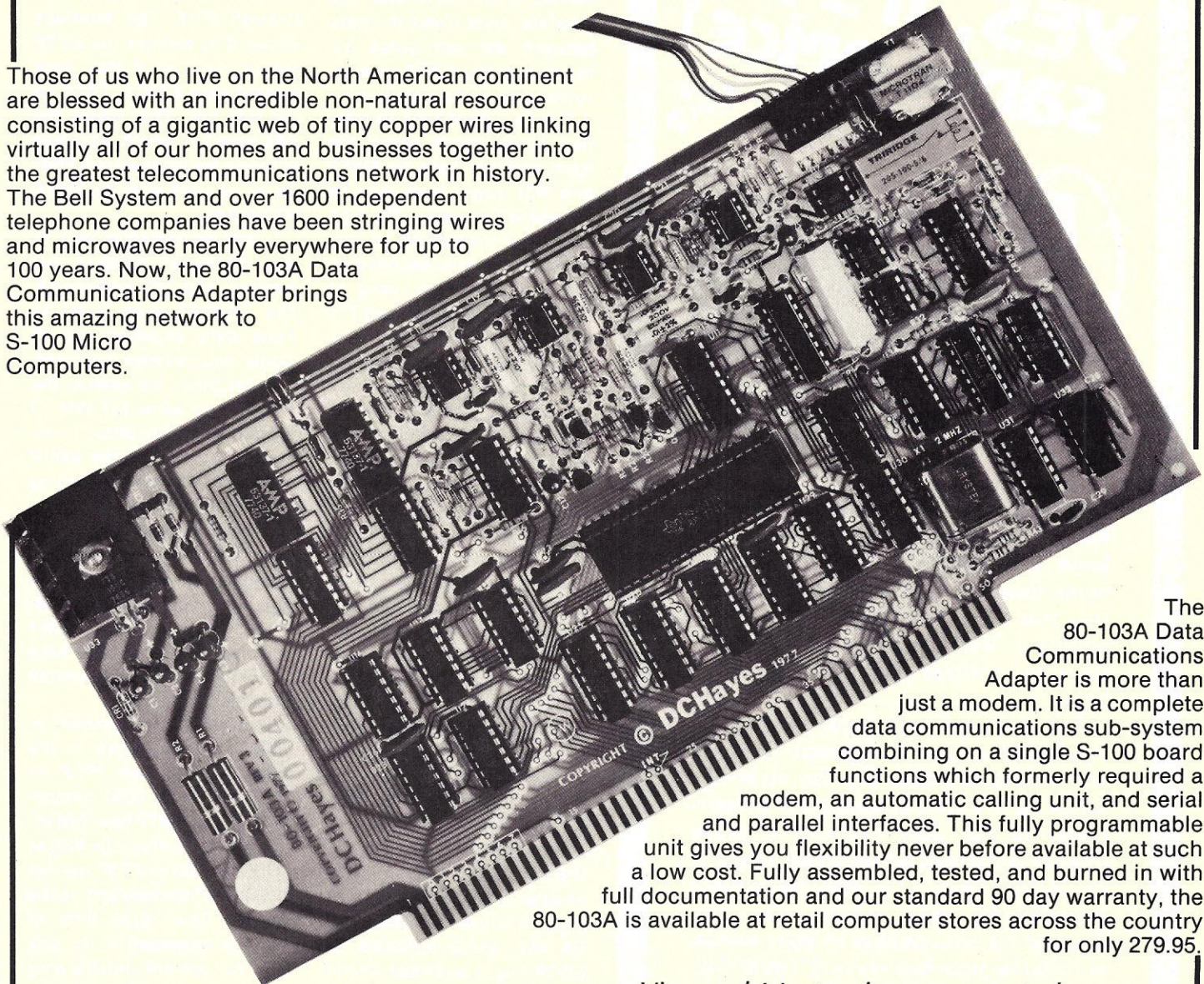


Fig. 3. Wave Mate Jupiter II to SWTP 6800 interface: SWTP section.

modem / 'mo • dəm / [**modulator** + **demodulator**] *n* - *s* : a device for transmission of digital information via an analog channel such as a telephone circuit.

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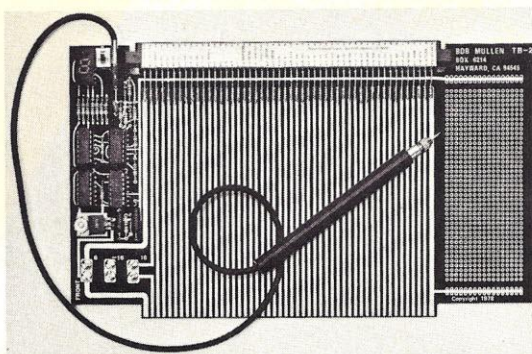
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connected.

The interface uses 26 unidirectional lines to carry information from one computer to the other. Twenty-one are used to supply information to the SWTP. The other five lines carry information to the WM from the SWTP. We will discuss these lines in more detail later.

The bidirectional lines (data lines) use 8T26 inverting bus transceivers at the WM end and 8833 noninverting bus transceivers at the SWTP end. The interface must invert the data between the two buses because only the SWTP uses inverted data on its main bus.

This is a good time to mention some points about the logic notation used by SWTP and WM. Logic levels can be defined in two ways—TTL high is usually considered as true and TTL low is considered as false; it is equally valid to define TTL low as true and TTL high as false. Using this negative, or inverted, logic changes the functions of most logic gates (e.g., a NAND gate becomes a NOR gate when the logic definitions are inverted).

Since it is convenient to mix both true and inverted logic definitions in any complicated logic design (it makes the design simpler), some convention must be followed in naming the lines to indicate their logic definition. SWTP uses an overbar to indicate that TTL low is defined as true; WM uses a superscript * for the same purpose. WM data lines are called DB0-DB7, indicating high level true, while SWTP data lines are called $\overline{D0}-\overline{D7}$, low level true. Other examples are the WM WRITE* line, which write enables the memory and I/O when it is low, and the SWTP BA line, which indicates the SWTP bus is available when it is high.

Several control signals from the WM bus must be modified before being placed on the SWTP bus. CLK, the WM phase 2 clock signal, must be inverted to serve as $\overline{\phi 2}$ on the SWTP bus. MEM and IO, used by WM for enabling memory and I/O devices, must be combined (using a NOR gate) to provide \overline{VMA} ,

which the SWTP bus uses for both purposes.

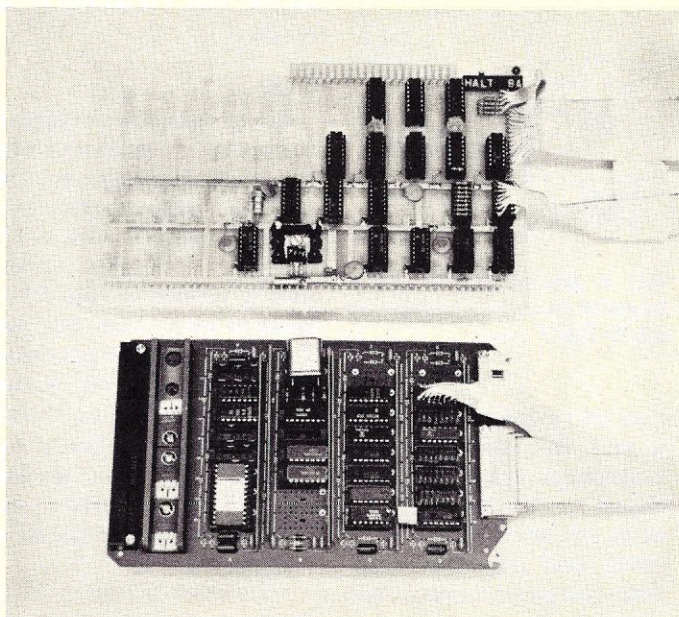
Memory and I/O Access

It is convenient to have the interface modify both memory and I/O port addresses. This allows both computers to see their own memory starting from 0000 and, in my setup, extending to 3FFF. The WM, however, sees the SWTP memory from 4000 to 7FFF and uses locations FF00 to FFDF for output ports, while SWTP uses 8000 through 801F. The interface allows it to address the SWTP output ports as if they were located from FF00 to FF1F on the WM bus. This allows the WM monitor, which assumes I/O ports are located from FF00 up, to be used with the SWTP I/O devices.

I used data-selector logic to get different offsets for memory and I/O addressing. The 74LS157 quad 2-line to 1-line data selectors act as 4-pole double-throw switches. Two 74LS157s are used in the interface to allow the WM IO line to control the offset in the address placed on the SWTP bus. When IO is high, indicating that the WM is addressing its I/O ports, the B inputs on the data selectors are selected. These inputs are hard-wired to give an address of 80XX. When IO is low, the A inputs are selected. These inputs have A15 wired low and A14 inverted from the WM bus.

These address-line modifications shift addresses in the range 4000 through 7FFF on the WM bus to 0000 through 3FFF on the SWTP bus. WM addresses not in the range 4000 to 7FFF or FF00 to FF3F will not enable the interface and can be ignored. The upper limit of 7FFF is necessary in my system to prevent interference with the WM video display memory at 8000 to 87FF. The display memory could be relocated (by reprogramming one of the monitor EPROMs), and all 32K of the SWTP memory space made accessible with minor changes in the interface logic.

The enable circuitry for both memory and I/O access to the



The complete interface. Only the two rear rows of the WM board (bottom of photo) are used in the interface. The other two rows are a WM serial interface.

SWTP bus requires that BA be high, which means that the SWTP A board is either halted or not plugged into the bus. Additionally, when BA is high, AB15 is low, AB14 is high and MEM is high, the 8T97 drivers on the SWTP bus are enabled for memory access. When BA and IO are high, AB7 is low and AB6 is low, the drivers are enabled for I/O access.

The data bus drivers are enabled whenever the 8T97s are enabled, but the direction (read or write) depends on the WRITE* line. The enable signals for the bus transceivers are generated and used on the SWTP interface board, but they must also be sent to the WM board to control the transceivers there.

Both the 8833 and 8T26 bus transceivers have their bus input and output terminals connected to the buses. This means that when the 8833s are enabled to write to the SWTP bus, the 8T26s must be enabled to read from the WM bus. Therefore, the read enable line for the SWTP becomes the write enable line for the WM, and vice versa. The 8833 enable inputs for both reading and writing are active low, but the 8T26 enable for reading is active high (the enable for writing is active low). I inverted the read bus line from

the SWTP on the WM board before sending it to the 8T26 write enable input.

The RPLY* line is used by the WM to allow stretching the WM CLK signal when accessing slow memory or I/O chips. The WM CLK signal is held high (up to 3.5 microseconds—us) until approximately .5 us after RPLY* goes low. Since the SWTP devices must be fast enough for a 1 MHz clock, RPLY* is pulled low by the interface whenever it is enabled and CLK is high.

The Master-Slave Relationship

Now let's look at how the WM can halt the SWTP when it wants to use the SWTP bus. The 6800 chip allows DMA by three different methods: halting, cycle stealing and multiplexing. The simplest method, and the only practical one using the SWTP, is halting. The SWTP MP-A board, which contains the CPU, the clock and the MIKBUG ROM and RAM, is designed for DMA by halting, but it does require a very minor modification for full DMA. Before we discuss the modification, let's look at how DMA by halting works on the 6800.

The 6800 microcomputer is halted, logically enough, by pulling the HALT line low. This line may not change state ex-

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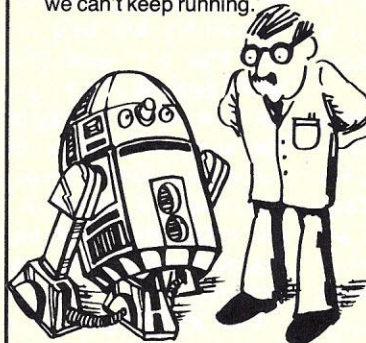
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cept during the first part of the machine cycle, but SWTP has provided a flip-flop, clocked by the phase 1 clock, on the MP-A board to satisfy this requirement. Therefore HALT, the SWTP bus line, can be pulled low or allowed to go high at any time. When low, the 6800 will complete its current instruction, remove itself from the bus and then set BA high. This process can take from 2 to 15 us, depending upon the current instruction.

The delay between pulling HALT and actually having the bus available (BA high) means that we cannot simply pull HALT and simultaneously use the bus. Some means of latching the SWTP into its halted state must be used. I used a flip-flop on the WM board for this purpose. When the WM addresses FFDC, the flip-flop is clocked, causing its output to change state. The output is connected, through a unidirectional line, a NAND gate and an inverter, to the enable input of an 8T97. This pulls HALT low when it is enabled and serves as a driver for the BA LED indicator on the interface board. The other input of the NAND gate is connected to a switch on the board to allow manual halting of the SWTP.

The CLR input on the flip-flop is connected to +5 volts from the SWTP board. This initializes the flop-flop to the non-halted state when the WM is powered up before the SWTP. It is important to allow the SWTP to initialize itself before it is halted, even if its CPU is not going to be used.

Although the SWTP MP-A board appears to have been designed for DMA by halting, the circuitry to control the data bus drivers when the CPU is addressing the MIKBUG ROM or RAM prevents a DMA device from reading from the bus. A simple circuit modification corrects the problem without interference to normal computer operation.

Two different logic paths are used by SWTP to control the direction in which the data bus transceivers are enabled. This is necessary because the data

lines to the MIKBUG memory are connected directly to the CPU data lines rather than the data bus. When MIKBUG is addressed by the CPU (addresses EXXX or AXXX), the normal logic path is overridden by the MIKBUG path. The transceivers are now enabled to write to the bus while the CPU uses the MIKBUG memory. Since none of the boards on the bus are enabled at this time, the data on the data bus are ignored.

When the computer is halted, the normal logic path is disabled, but the MIKBUG path is still active. When the R/W line is low (DMA device writing to the bus), the transceivers are enabled to read from the bus. This does not cause any problem. When the R/W line is high, the data bus transceivers are enabled to write to the bus, regardless of the address on the bus. This means that when the DMA device tries to read from memory or I/O on the bus, data bus drivers on both the board addressed and on the MP-A board are enabled. A prime rule of bus usage, "Thou shalt not have more than one set of drivers enabled at any time," is violated, and only garbage can be read from the bus.

To correct this problem, keep the data bus transceivers in a read from bus mode when the computer is halted. The first gate in the MIKBUG read/write circuit is a NAND gate used as an inverter by wiring its inputs together. When the output of this gate is high, the data bus transceivers are held in the read from bus mode. Since a NAND gate will have a high output when any of its inputs are low, separate the two inputs and use one to hold the output high when BA is high. A line that is low when BA is high is available, conveniently, on the same IC.

The NAND gate is one-quarter of IC12 on the SWTP MP-A board. Pins 4 and 5 of this IC are the inputs tied together to make an inverter, and pins 1 and 2, also tied together, have a line connected to them that is low when BA is high. I cut the foil connecting pins 4 and 5 and ran a short length of insulated wire

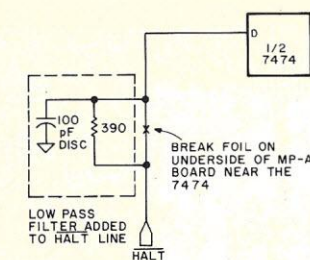


Fig. 4. Modification to MP-A board to cure noise problem on SWTP HALT line.

from pin 4 to the line coming into pin 1. When BA is high, this modification keeps the transceivers in the read from bus mode, but, when BA is low, the NAND gate acts like an inverter, just as in the unmodified circuit.

With this modification (or, for that matter, without it), the interface cannot read or write the MIKBUG ICs. Because of the MP-A board's design, no DMA method can use the MIKBUG ROM or RAM without added circuitry on the MP-A board. Because of the difficulty of modifying this board, I suggest that if you need this capability you relocate the MIKBUG circuitry to some other card in the system (e.g., the interface card).

One of the ways I hope to use my slave computer is as an I/O controller for the master computer. By connecting all of my slow I/O devices to the slave computer bus and programming it to handle the printer, cassette, etc., which often take the majority of a microcomputer's time, the time available to the master computer to do calculations and data manipulations is greatly increased. There is nothing original about this idea; I suspect all large computers work this way.

To make the interface more flexible, I've incorporated a line that allows the SWTP to inform the WM whenever it needs attention. When the SWTP addresses its 0 I/O port, the WM gets a signal on its #4 interrupt line. Since the WM uses a vectored, maskable interrupt scheme, it can be programmed to go to an I/O service routine when it is ready for I/O and the SWTP has indicated, by inter-

rupting, that it is waiting to be serviced.

Bugs

I have used my two-computer system for approximately two months, and only one problem has come to light: a noise problem in the SWTP! The HALT line, as I mentioned earlier, uses a flip-flop on the MP-A board to synchronize changes in the HALT line with the phase 1 clock. This is a TTL device that will respond to very short pulses on the bus line. I discovered that noise on this line was causing the SWTP to execute occasional single-cycle operations.

Fortunately, the cure for this problem was simple. I inserted a low-pass filter into the line on the MP-A board before it reaches the flip-flop (see Fig. 4).

This problem was due to noise pulses originating in the interface, not on the SWTP bus. It will not cause trouble if the SWTP is halted by means of a switch connected directly to the bus line and ground with short, reasonably large, wires.

Summary

Few, if any, will want to build an exact copy of my interface. However, the basic interface design and many of the ideas are applicable to anything from adding a bus to a one-board microcomputer to interfacing two microcomputers using different CPU chips. This is a wide-open area for hobbyist exploration.

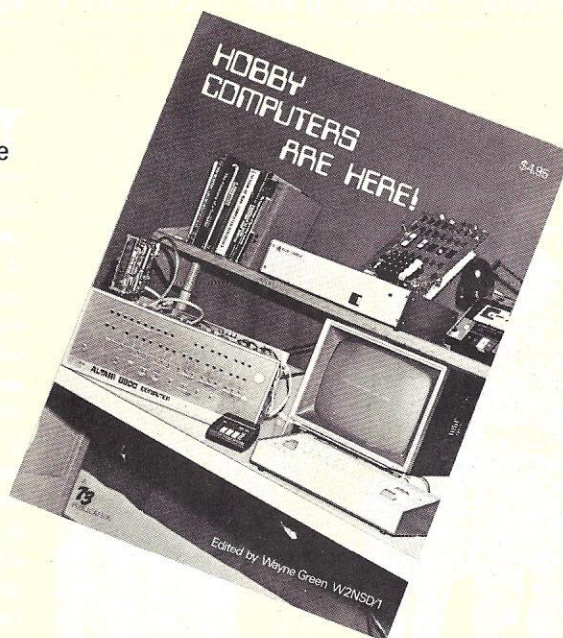
Many people probably feel that interfacing two different computers is too complicated for anyone without an extensive technical background. Actually, if the two computers use the same CPU chip, it is a straightforward and rewarding project. It took me less time to design and build the interface between my two computers than to build an RS-232 interface for my keyboard/printer. All of the critical timing relationships are already taken care of by the computers. All you must do is get the signals between the computers and modify those signals that are different on the two buses. ■

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Computers in Classrooms: Teaching the Teachers

Three big markets for personal computers will exist in years to come: small businesses, homes, schools. Educating the educators is something we can all get involved in.



Photo 1. A large computer installation.

(Courtesy of IBM)

Today there is no reason why every elementary and secondary school should not have computers. Their potential uses are obvious and their cost is remarkably low. But widespread use of computers in classrooms will come only when teachers realize their value. This article discusses the possible uses of computers in classrooms, and describes workshops my associates and I have held for local teachers. My aims, here, are to present the criteria for these workshops, discuss the problems that we faced in organizing them, describe what we learned from our experiences and encourage others to help in this task of "educating the educators."

Facing the Problem

Any reader of this magazine is certainly aware that computers will soon be as much a part of daily life as typewriters, refrigerators, automobiles and television sets. Such everyday items surely must be part of classroom education at all levels. Students must grow up with the computer much as they grow up with the other

products of our culture.

But the computer is not only a new household item, it is also a versatile tool that can aid in education. Computers can handle routine tasks such as grading and record keeping; help in generating class materials and providing self-paced review; and even supply simulated experiences ranging from simple games to complex system tasks. The possible uses of computers in education are unlimited. Now the sharp reduction in the cost of computers has made many of these uses economically feasible.

One obvious problem is that few teachers have the background required to take advantage of computers. Even science and mathematics teachers have seldom had more than a cursory (and often outdated) introduction to computers. These introductions typically treat the computer as a high-powered calculator, capable only of solving mathematical problems. Most teachers share such common public myths as:

1. Computers are intelligent and answer all questions posed

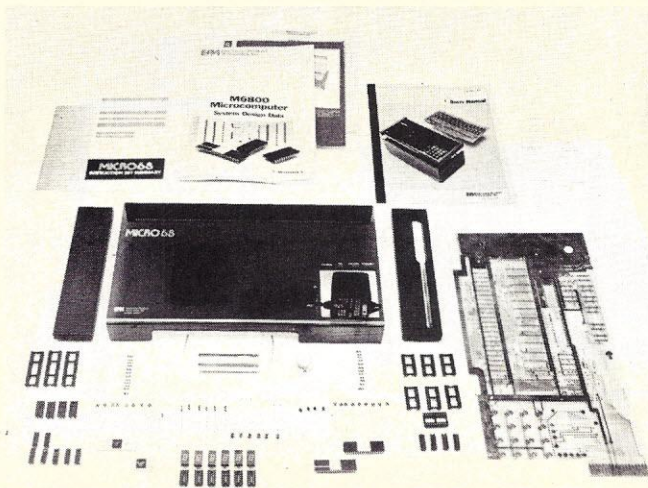


Photo 2. The Electronic Product Associates Micro-68 (exploded view shows components). (Courtesy of Electronic Product Associates)

to them (presumably in an eerie metallic voice).

2. People who work with computers must be wizards or mathematical geniuses. Computers remain remote and mysterious to the "man on the street."

3. Computers are depersonalizing, unimaginative and insensitive. Furthermore, they will eventually take over everything.

4. Computers are always right, or at least think they are. Somehow, though, they can always be outsmarted by a few extraordinary (or even ordinary) people.

5. Computers are large, very expensive and very complex. Average people can only look at an installation like that shown in Photo 1 from behind closed doors.

Even teachers who have some computer background are often unfamiliar with the new, low-cost microcomputers. Since teachers are already expected to be expert in sociology, anthropology, psychology, ecology, health and other subjects, this lack of familiarity can hardly be surprising.

On the other hand, most computer specialists (like myself) are unfamiliar with the problems of elementary and secondary teachers. Their needs and requirements are different from those of teachers at the college level. Elementary and secondary teachers need

solutions to their problems, not just new tools that are difficult to use or understand and will simply clutter the classroom.

The Role of Computer Clubs

The personal-computer movement has some unique characteristics that can be used to solve this educational problem.

- Many personal-computer enthusiasts are newcomers to computing. They can therefore help alleviate fears that only experts can understand computers. Many computer-club members are themselves teachers.

- Personal-computing stores, magazines, conferences and clubs cater to the novice. They provide information at a variety of levels. Furthermore, other hobbyists are often willing to help novices.

- Personal computers are not financially out of reach for most schools. Complete units can be priced as low as \$600, a cost comparable to that of a typewriter or television set.

- Personal computers are designed to be used by non-experts. Their size, appearance and operating methods make them far less forbidding than larger computers and far easier to explain.

Planning a Workshop

The potential for personal computers in the classroom is there but how do you translate

it into reality? The rest of this article will deal with our experiences in offering personal-computer workshops to teachers. I hope you'll get some idea of approaches to take and pitfalls to avoid.

The original idea grew out of a microprocessor course I offer at Grossmont College. Although the course is primarily intended for engineers and technicians, many hobbyists also take it. Among my students was Dr. Russ Cassel, a well-known specialist in computer-aided instruction who is presently retired from the U.S. Air Force and from a professorship at the University of Wisconsin, Milwaukee. It was Russ who suggested we hold a workshop for teachers.

Since I am interested in continuing education and have given some workshops for engineers, I decided that the idea was worth pursuing. Our group finally decided on the following guidelines:

1. We would not assume that attendees had any previous background in computers.

2. We would emphasize the current state of the art in low-cost computers.

3. We would try to emphasize that you didn't have to be either an expert or a mathematical genius to use a computer. One approach would be to have

local teachers and other non-experts explain how they were using computers.

4. We would try to give all participants some hands-on micro-computer experience.

5. We would hold all-day Saturday workshops at no charge.

Our net assets when we started were:

1. Cooperation from Grossmont College, which provided a room, reproduction of materials and some secretarial help. This was largely arranged by Dr. David Lien.

2. Cooperation from a local microcomputer manufacturer, Electronic Product Associates. This manufacturer agreed to supply us with some Micro-68s for the hands-on experience. The EPA Micro-68 is a Motorola 6800-based microcomputer that has a hexadecimal keyboard and display (see Photo 2), and can therefore be used without a terminal. It is also available in more elaborate configurations (see Photo 3) with various peripherals.

3. Help from some local computer enthusiasts, including present and former teachers.

Finding Willing Victims

What we lacked (besides good sense) were teachers (i.e., guinea pigs for this experiment). The obvious place to start was at nearby high

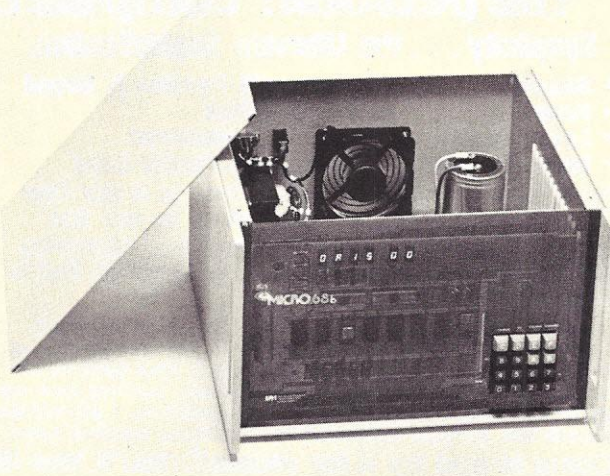


Photo 3. The Electronic Product Associates Micro-68b, a larger version of the original Micro-68. A printer, TV interface, cassette interface and floppy-disk system are available with this computer. (Courtesy of Electronic Product Associates)



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CONVERSATIONAL QUERY CAPABILITY

Data retrieval is equally easy. You can query the system directly about any data item on file, or you

may inquire about any heading. All that's required is a pidgin English "Request," such as "WHEN'S DR. JEKYLL'S APPOINTMENT?" System response time is usually a matter of seconds.

Up to two headings may be specified in a single Request, a capability that makes possible versatile cross-indexing within the data base.

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For easy installation, the WHATSIT programs are supplied in the widely available North Star BASIC, and can be installed without modification on any S-100 bus (8080 or Z-80) computer equipped with a North Star disc system and at least 24K bytes of random access memory (RAM). For other disc systems or non-compatible computers, the programs would require modification.

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Photo 4. The Computer Power and Light COMPAL-80 Microcomputer. This system comes completely assembled, including the keyboard and TV monitor, for about \$2300. Printers and floppy disks are available at extra cost. (Courtesy of Computer Power and Light)

schools; so we started to wade through the various bureaucratic levels. Surprise—the people at the first school we contacted were positive and enthusiastic. They had been using a time-sharing system and were anxious to learn about micros. This response was, of course, encouraging, and it turned out to be the only encouragement we would receive from any school.

The general response was: "What are you trying to sell?" "The person who handles computers is on vacation." "We're busy right now with exams, parent-teacher meetings, law enforcement, football, etc., but do call us back (preferably when we're out)." "I'll route the matter to our mathematics coordinator; he (or she, or it) will get back to you. But don't hold your breath."

The lesson here is that you'll need some patience (and some aspirin). Teachers are not lining up, waiting to find out about computers. You have to reach them and sell them on the idea; and that takes time and effort. A few notices or a few telephone calls will not do the job.

Fortunately, we wanted to start small and we had no illusions about a huge crowd. (Remember that we wanted to include hands-on experience.) In fact, our initial group was fifteen, padded by two deans from Grossmont College and a

few ringers from the local computer club.

The Initial Program

The program consisted of two talks: one by me and another by Dr. Melvin Zeddies of United States International University. Mine, "An Introduction to Computers," described what a computer was, what made up a working system, what was presently available and how much it cost, what the future trends might be, where you could get more information, and how you might want to use a computer in the classroom. Copies of the slides are available from me for anyone who is interested.

Dr. Zeddies talked about his experiences in building several small computers for use in a high-school program for gifted students, covering such matters as how to obtain funding, build and maintain the computers, write programs, and provide some continuity in computer operations.

In addition, three local computer enthusiasts—Gary Mitchell, Laura Thomas and Carl Palechek—described their experiences with personal computers. The program was rounded out by a laboratory session which involved writing and executing several short machine-language programs.

In general, our participants found the workshop interesting

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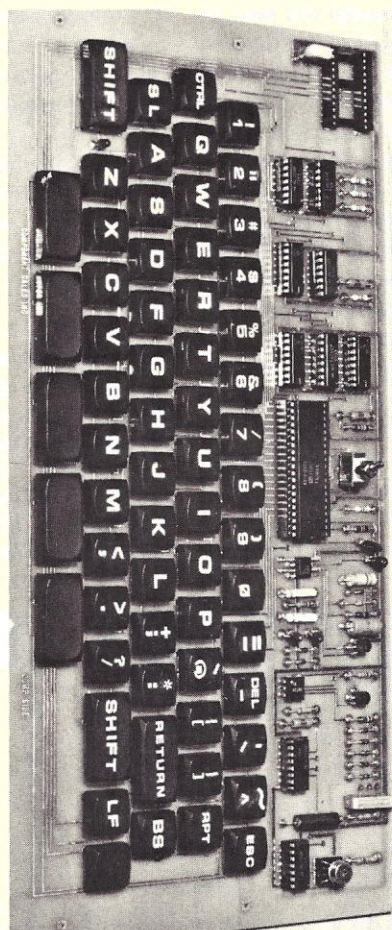
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experience and to help teachers perform routine tasks.

The problem of reaching our potential audience remains a serious one. Clearly a small volunteer group cannot put a massive, continuous effort into publicity, personal contacts and telephone reminders. We are now trying to work through the San Diego County Department of Education and we're hoping the department can handle the difficult task of reaching that audience.

Overall, I think this experience has been useful, even though it is little more than a beginning. In fact, I may have learned more than the teachers since I have become acquainted with school administrations, financing methods, district policies and school problems. I have had an opportunity to see Bob Albrecht in action (he's fabulous), and to meet a large number of concerned educators.

Some Suggestions

Teacher education presents a real opportunity for local computer clubs and enthusiasts. I suggest the following guidelines.

1. Work through your local school district or county department of education. Otherwise the problem of publicity is enormous.

2. Explain computers from the beginning. Don't assume teachers have any background, particularly familiarity with the personal-computer movement. Remember that S-100 bus, Altair, Imsai, floppy disk, RAM, ROM and other such terms are not common knowledge.

3. Emphasize how teachers can use computers to help with everyday classroom tasks. Try to bring in local teachers who have actual experience with small computers.

4. Don't hesitate to include some games and other attention-grabbers—teachers are almost human, after all. Include some useful programs as well.

5. Include some organized hands-on experience, preferably involving programming low-cost computers in BASIC.

but had some reservations. Our real problem was that the EPA Micro-68 computers were not the type that would be useful at the elementary or secondary levels. These computers are really intended as digital trainers or prototyping systems for engineering applications. Several teachers suggested that they were interested in complete systems with adequate peripherals that could be programmed in a high-level language (preferably BASIC).

Furthermore, we had to show the teachers that personal computers could be a useful classroom tool. Several teachers said they needed to see things that they could use immediately, rather than just hear suggestions. We had to sit down and really think about how to sell teachers on utilizing computers.

The participants generally did not want to assemble kits, attach peripherals or maintain their own computers. They had neither the facilities nor the time for that approach. The only attraction of kits was that they could be purchased as instructional supplies rather than as capital equipment. Most school districts (like many companies and government agencies) have elaborate procedures for purchasing computers. Although these procedures make little sense now that computers are so inexpensive, they will remain an obstacle to computer purchases for many years.

Some Further Efforts

Since that first effort, we have held two more workshops. We now have cooperation from Computer Power and Light, a manufacturer of complete microcomputer systems that include a keyboard, monitor and audio cassettes (see Photo 4). These systems come assembled, and can be programmed in BASIC. The manufacturer provides local maintenance and some software. We are now trying to emphasize the use of computers to aid in remedial education (they have infinite patience), to provide simulated

Actual experience is the only way to overcome the fear of computers so many people feel.

6. Discuss sources of additional information and equipment. These sources include computer clubs, stores and magazines. *Calculators/Computers* magazine is a new journal that deals specifically with educational applications. (I will gladly provide a list of selected books and magazines.)

7. Emphasize complete systems that do not require a high level of expertise to build, use or maintain. Explain some of the pitfalls, but don't make the road seem too hard to travel.

8. Be sure to note that we

don't have all the answers yet. The entire personal-computer business is only a few years old, and most of the exciting developments are still ahead of us.

9. Try to get actual systems into schools, even if just for an afternoon. In-school demonstrations help create publicity and encourage students and teachers.

Acknowledgements

I am glad to be able to thank the following people for their invaluable assistance:

Dr. Russ Cassel, whose energy and enthusiasm should be a guide for all of us.

Dr. Melvin Zeddies, a first-

class speaker and educator.

Dr. Jane Gawronski of the San Diego County Department of Education.

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Mr. Victor Wintriss and Ms. Patti Neumann of Electronic Product Associates.

Mr. Michael Scholnick, Ms. Dianne Simpson and Mr. Ian Law of Computer Power and Light.

Mr. Wirt Atmar of Ai Cybernetic Systems, for providing a cassette describing Cybernetic's speech synthesizer.

Also—Carl Palechek, Ed Nagy, Gary Mitchell, Laura Thomas, Irv Stafford, Peter Young, Robert King, Lewis

Freed, and many others. John Craig of *Kilobaud* has been a constant source of encouragement. ■

References

H. Dyk, "Put a Micro in Your School," *Kilobaud*, June 1977, pp. 38-40.

D. Inman, "Computers for Free!" *Kilobaud*, March 1977, pp. 42-45.

S. Clarke, "A PET for Every Home," *Kilobaud*, September 1977, pp. 40-42.

Calculators/Computers magazine, edited by Don Inman (assisted by Bob Albrecht). Available for \$12 per year from DYMAX, PO Box 310, Menlo Park CA 94025.

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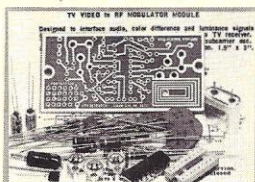
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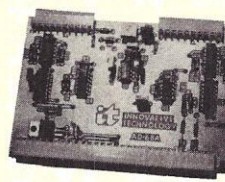
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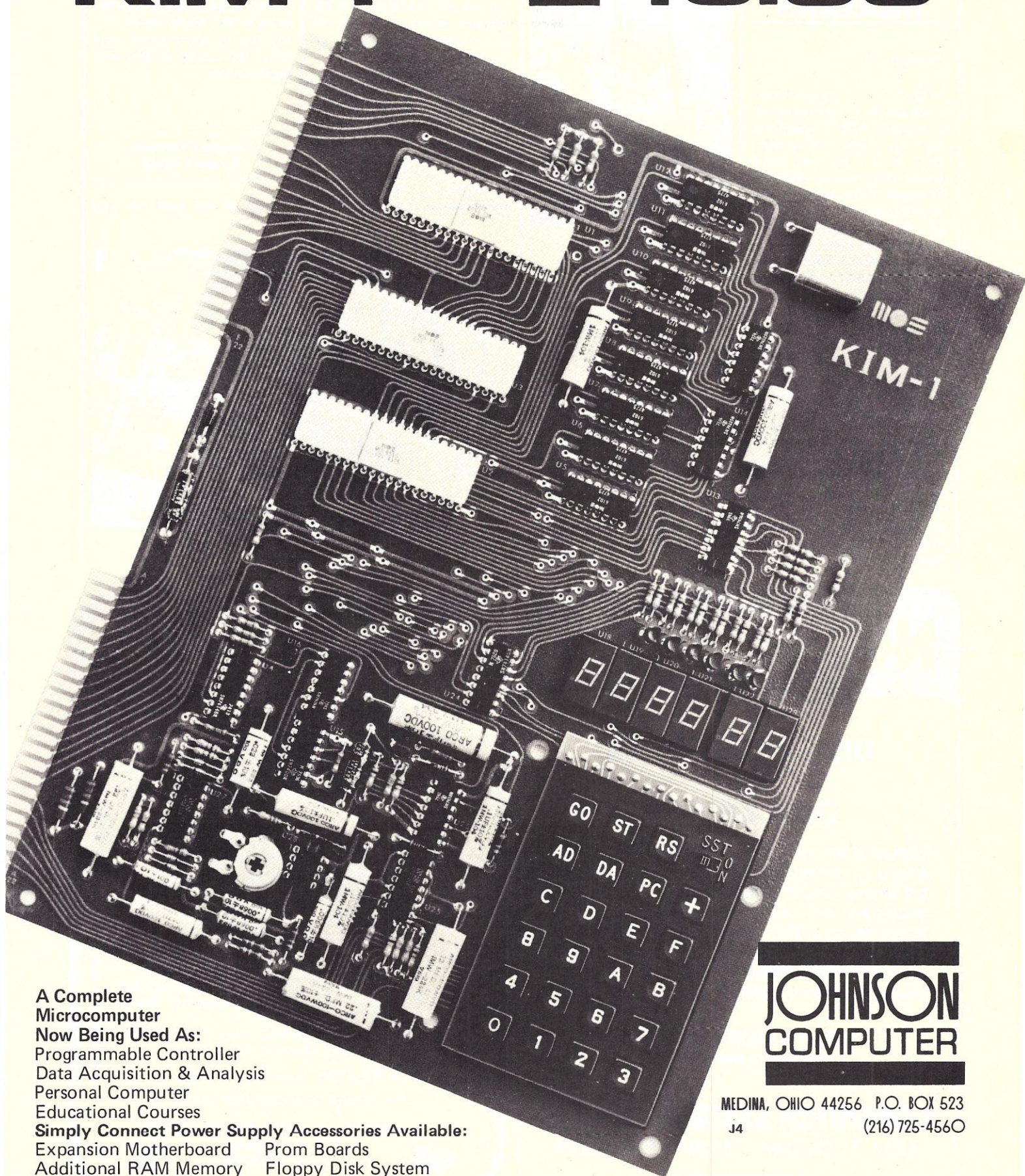
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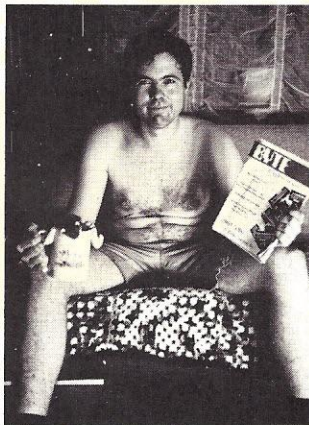
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PUBLISHER'S REMARKS

(from page 7)

the case: "... the plastic is not strong enough to keep the fasteners in place. After I opened the top a few times both fasteners broke loose." He also found trouble with the cover uprooting the keyboard when he removed it. He particularly had trouble with the color TV monitor and discussed that at great length... including a severe problem he had with radio frequency hash from the computer. He stressed this a couple of times and then went on to gripe that there were no peripherals available for the Apple bus.

He didn't like the game paddles supplied, so a great deal of the article was devoted to his making his own joystick, an engineering triumph of which he seemed extraordinarily proud. He left me with the strong impression that before I could do much with the Apple I would have to duplicate his chore of buying all the parts and building my own joystick. I would then have to dig into the Apple and wire my new control



Byte editor Helmers.

system directly into the computer before I could use it. This would obviously ruin the portability of the unit and I doubt if I could get the bottom cover back on. Phooey.

Helmers didn't like the BASIC supplied. "But the 5K BASIC, even given its string capabilities, is not what one would want to use.... The people at Apple have hacked the (BASIC) interpreter... had to sacrifice two statements: LET and REM." This in order to have graphics. He beefed about the lack of the high-resolution software package...

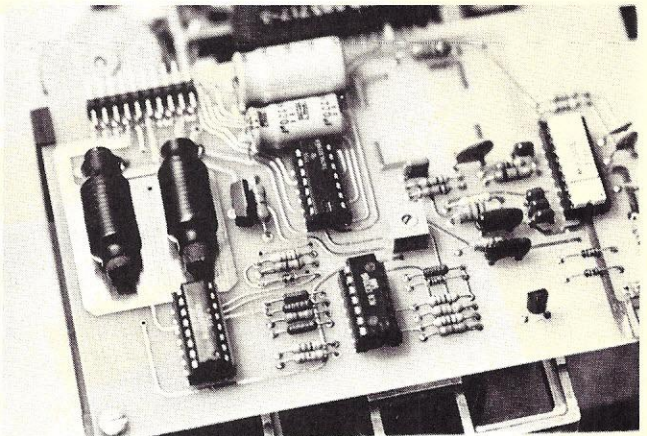
called the applications software "a mixed bag"... didn't like the loose-leaf documentation and the lack of tutorial on how the computer works... and found the documentation "scanty" on the BASIC interpreter.

Absent from the review was any objectivity or discussion of the benefits of the system to the beginning computerist. He said nothing about where one could get applications software for the system... how easy it is to use and to learn... how many people are able to sit down and learn

the fundamentals of microcomputing in a few hours with the Apple, etc. Obviously he had no interest in the tremendous enthusiasm of the Apple owners... any one of whom could have done a far superior job of reviewing the system.

Computer Portraits: Up and Coming

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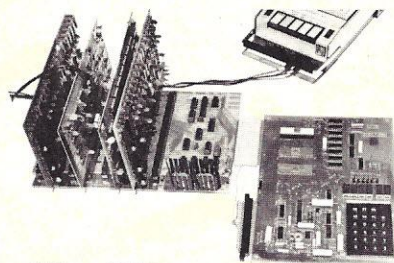
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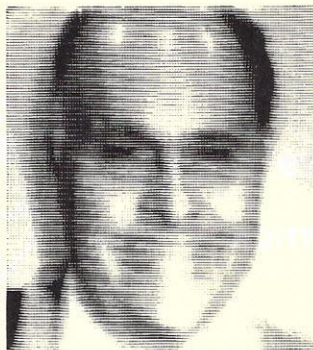
computer-portrait outfits at shows, shopping centers, fairs, vacation spots, etc. It turns out, according to a release from Centronics (which we'll be publishing) that there are fortunes to be made with these systems.

One of the exhibits at the San Jose show was a portrait system by Micro Works, a new outfit in Del Mar (California, of course). Their price for a complete system was ridiculously low . . . around a quarter that of one of the lowest-priced commercial systems. While the cost of the equipment needed to make \$100,000 in sales (mostly profits) over a six-week period is not relevant if it's under \$50,000 . . . not many locations will produce that amount of dollars . . . so a few bucks saved is a few bucks earned.

Since many computer hobbyists are not totally opposed to making money with their systems, we'd like to have some articles on commercial applications of microcomputers . . . such as for computer portraits.

First European Microcomputer

The European agents for *Kilobaud* have forwarded informa-



tion on NASCOM 1, a micro-computer kit selling for 980 DM (from an address in Trier, W. Germany). The system uses a Z-80 chip and has its own bus structure, which the literature doesn't divulge. They do have a NASCOM to S-100 bus interface board available, so any of the hundreds of S-100 boards can be used with the system. They also have a Kansas City cassette interface available.

The kit includes a full alphanumeric keyboard and character generator. It requires a TV set for video display and a separate power supply (another 130 DM). It appears to have 4K of memory and includes a small operating system (NASBUG) in ROM and its own cassette system, not com-

patible with any other known system (as usual).

My plans are to be in Europe in May, and I hope to have a fuller report on NASCOM after the May show in Paris. Trier is quite near the Luxembourg border, and is not that far from Paris. It is a beautiful old city, with many Roman ruins . . . such as the remains of extensive outdoor baths, and a coliseum for Roman games. I won't have a chance to get up there to see the NASCOM distributor; however, perhaps I will have a chance to visit the factory in the UK on the way to Paris.

Buying Mail Order

There are several firms that are not permitted to advertise in *Kilobaud* because we have had so many complaints about them. But, outside of checking the ads in *Kilobaud*, how can you protect yourself against rip-offs? Not that an ad in *Kilobaud* is positive proof of anything because we get taken in too . . . and of course there are still some credible advertisers who are not running ads in *Kilobaud* for reasons of their own . . . odd as this may seem.

To get your best shot at not getting a bad deal, I suggest the following procedure. This has to do with firms about which you may have a question . . . not steady advertisers in *Kilobaud* such as S.D. Sales, Godbout, etc. Before you plunk a big bunch of money in an envelope, take some precautions.

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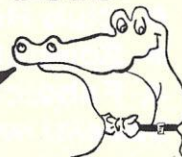
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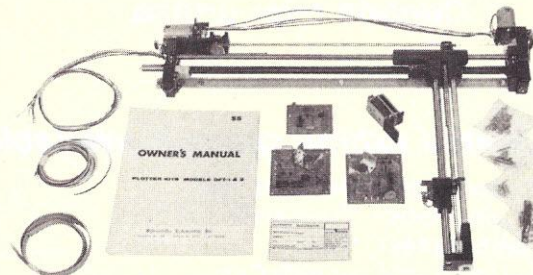
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Book Manuscripts Wanted

The *Kilobaud* book department has been expanded recently and several books are in the works; more are needed . . . if you are looking for fame and fortune.

A publisher has two major functions, and *Kilobaud* is uniquely suited to both of these. First comes the printing of the book, which can be an expensive proposition. In our case, we edit the manuscript, do the drafting of any schematics, set the type, do needed photography, proof-read the type, lay out the pages, put the type, photos and draftings together on the page, shoot the negatives, make the printing plates, buy the paper, print the book, bind it and ship it. Everything is done right at *Kilobaud*! Few publishers have such a complete setup . . . or one nearly as efficient.

The second function is advertising and distributing the book. Again we have everything, including a magazine to help with the advertising. Our marketing staff prepares promotions for computer stores, bookstores, radio stores, etc. Our sales staff is in touch with all possible book outlets. With over a dozen books now being distributed, we know the market well.

What kind of books are needed? Microcomputer-fundamental books are still selling well, despite the large number of them out there. Books of programs for

microcomputer-users are exceedingly popular. Books on programming sell well. Heck, almost any book on computing sells. What are you waiting for? Wouldn't you like to see your name on a book cover?

If you have a book in the works you can do worse than get in touch with our book department and see if you have something viable. It sure is nice when those royalty checks come in.

Good News and Bad News

Perhaps you've noticed that prices on everything have been inching up. As long as we are all so enthusiastic about supporting an ever-growing government, one that has a strong vested interest in spending, not saving, inflation is going to be a fact of life. You've probably read about the recent postal hike and you may know about the next one that's coming. I sense that something has changed in postal rates for maga-

zines when I have to pay 72¢ a copy to mail an issue of *Kilobaud* and remember when I paid 5¢ each to mail *73 Magazine*.

The excuses include more than postage. Paper has doubled in price in recent months, with the grades of paper we used to use being phased out and forcing us to use what the paper mills are making . . . paper so thin it is getting difficult to turn a page without skipping one or two and hardly noticing it. Printers, needing bigger Rolls Royces and yachts, have upped their take . . . and so it goes.

The bottom line is an increase in *Kilobaud*'s one-year subscription to \$18. Since about half of our subscribers opt for a three-year subscription for \$36, and we are not increasing this price, the net to us will be about 11 percent. This will put us back where we were when *Kilobaud* started.

With a very high percentage of the renewals coming through for three years, it will be the newcomers to the magazine who will foot the inflation on the one-year rate.

EDITOR'S REMARKS

(from page 7)

or give me a call for reservations and booth costs.

John Craig, RFD Box 100 D, Lompoc CA 93436, (805) 735-1023.

Article Submission

Hey, if you're going to write an article *don't* send it to more than one magazine at a time, OK? That isn't the way the game is played. I don't think any of us likes to be put in a position of "bidding" on a piece of material (and I won't), but even worse than that are the possible messes that can occur.

My most recent experience involving dual submissions resulted

LETTERS

(from page 20)

```
210 IFS(A)<>0THEN350\M2=0
215 Y1=Y1+1
220 FORZ9=0TO8STEPQ9
225 IFC9(A,Z9)=0THENEXIT320
230 A6=C9(A,Z9)\A6=V(A6)
240 IFA6<0THEN300\IFA6=11THENV(A9)=-1
260 IFA6=3THEN265\GOTO270
265 M4=A\GOTO390
270 IFA6=0THEN300
280 IF5>A6THEN285\GOTO290
285 M2=M2+A6\A6\GOTO300
290 A7=INT(A6/5)\IFA7=A6/5THENM2=M2+A7
300 NEXTZ9
320 IFM2>M3THEN325\GOTO350
325 M3=M2\M4=A
350 NEXTA\IFY1=1THEN355\GOTO390
355 PRINT"IT'S A DRAW"\END
365 FORA1=0TO3\A6=W(A1,M5)\IFS(A6)=0THEN366\GOTO367
366 M6=A6
367 NEXTA1
368 PRINT"THE OLD",M5
370 S$(M6,M6)="C"
375 A1=INT((M6-1)/16)+1\A2=M6-((A1-1)*16)
380 PRINT"I WON WITH BOARD",A1," POSITION",A2\GOSUB1000
382 END
390 S$(M4,M4)="C"\S(M4)=5
391 U2=M4\U4=5\GOSUB1400
392 A1=INT((M4-1)/16)+1\A2=M4-((A1-1)*16)
400 PRINT"I WENT BOARD ",A1," POSITION ",A2\GOTO90
410 PRINT" \PRINT"YOU WON"\GOSUB1000\FND
1000 PRINT"POSITIONS ARE",\FORA=0TO3\FORA1=1TO13STEP4\A2=20+(A1*4)
1100 PRINTTAB(A2-4),A+A1,\NEXTA1
1102 PRINT" \NEXTA\PRINT" \PRINT"
1105 FORA=0TO3\PRINTTAB(A*15),"BOARD",A+1,\NEXT\PRINT"
1107 PRINT" \PRINT"
1110 FORA=1TO4\FORA1=0TO48STEP16\A2=A+A1
1120 PRINTS$(A2,A2),S$(A2,A2),"/",
1121 PRINTS$(A2+4,A2+4),S$(A2+4,A2+4),"/",
1122 PRINTS$(A2+8,A2+8),S$(A2+8,A2+8),"/",
1123 PRINTS$(A2+12,A2+12),S$(A2+12,A2+12)," ",
1124 NEXT
1125 YFA=4THEN1130
1127 PRINT\FORA2=1TO4\PRINT"////////// ",\NEXTA2
1130 PRINT" \NEXTA\PRINT" \PRINT" \RETURN
1400 FORU1=0TO8
1410 U3=C9(U2,U1)
1420 V(U3)=V(U3)+U4
1430 NEXTV(O)=0\RETURN
```


from a record-keeping error on the author's part. It turned out he had submitted the article to another magazine, forgot about it and then sent it to *Kilobaud*. It initially blew my mind when I saw an article that I'd already bought in print . . . in another magazine.

We finally got things straightened out; but to paraphrase an oft-heard democratic dictum: "One article, one magazine."

NEW PRODUCTS

(from page 17)

age differential of bus signals that are asserted "high."

The Extensys device provides glitch-free signals (no spikes interference, crosstalk) by bringing some well-documented analog techniques from transmission-line analysis to the digital world of S-100 computers.

The "Glitch Grabber," which easily plugs into any open slot on the S-100 bus, features a proprietary self-regulating transistor network that controls voltages and modifies circuitry to handle less or more voltage; the circuitry is activated, however, only when the glitch is there, so it does not load the S-100 bus signals.

The "Glitch Grabber" is also very effective when used in business applications where reliable operations are of prime concern.

Extensys, 380 Bernardo Ave., Mountain View CA 94040.

PET-488 Cable Assembly

The Pickles and Trout PET-488 cable assembly makes your PET computer plug compatible with any IEEE-488 device. The PET computer can become the controller for a wide variety of electronic test equipment and computer peripherals. You can use your PET as the basis for an automated testing system or you can take advantage of the numerous peripheral devices (more appear every month) that can talk to the IEEE-488 bus.

The PET-488 cable assembly plugs directly into the edge connector on the back of the PET computer and has a completely 488 compatible connector on the other end. The cable itself meets all IEEE-488 specifications for

shielding and crosstalk and is 18 inches (.45m) long. Price is \$30 (California residents, please add 6 percent sales tax).

Pickles and Trout, PO Box 1206, Goleta CA 93017.

Professional Software

The Comprehensive Mailing List Program Package, #ML-INS, is a modular program set which enables the user to start and effectively maintain one or more mailing lists. Operations include: Add, Delete, Search, Sort, Auto-Sort and Sequential Print-out. Features include: user-selectable defaults for ease of entry, user-selectable number of labels across page for different printers and label sheets and user-selectable 3- or 4-line address for each independent entry. The program set is written for convenience and ease of use. Available with complete documentation and North Star diskette for only \$25 ppd.

Delivery is from stock. Documentation package only is \$4.50 ppd, fully refundable with order for diskette. Order from: Williams Radio and TV, Inc., Computer Division, 2062 Liberty St., PO Box 3314, Jacksonville FL 32206.

BOOKS BOOKS BOOKS

(from page 12)

impression of two guys talking to each other. The result is a very readable pair of books that are also extremely informative.

The books aren't flawless, of course. The most irritating things are the typographical errors. Fortunately, only a couple of them are likely to cause you any confusion while reading. An errata sheet will be available soon. Sorry, but even though I tried, I couldn't come up with anything else bad to say.

In short, these books are ideal for someone who is just getting into home computing. Even for the more experienced reader, they tie up a lot of the loose ends and show the relationships among things that may not have been clear before.

Tom Rugg
Los Angeles CA



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09

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Kilobaud classified advertisements are intended for use by those individuals desiring to buy, sell, or trade used computer equipment or software. No commercial ads are accepted.

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PET owners—train your new PET with this software: try Dictator at \$10 or King at \$7.50, or a tape of 10 games at \$20. Send SASE for complete list. Guaranteed. Dr. Daley, 425 Grove Ave., Berrien Springs MI 49103.

TDL Xitan, 34K—250n SMB, video display brd ZPU, keyboard, 12" TV, \$2095, Jon Batcheller. (904) 373-7004.

Sophisticated 2-player football simulation on cassette for Radio Shack TRS-80 Level 1 BASIC. Uses graphics to draw field, move ball, etc. \$12. Dr. S. Harter, Box 17222, Tampa FL 33682.

PET users need info? Getting started with your PET workbook, \$4. Workbook has helpful info, sample programs, exercises and fundamental features of PET BASIC. Send SASE for details. D. Smith, Box 921, Los Alamos NM 87544.

ADM-3A with upper/lowercase. Brand new. Guaranteed working perfectly. \$600. Write: Terminal, PO Box 2467, N. Canton OH 44720.

For sale: Heath H8, H9, 12 K mem assembled. ccp-3801 recorder Ext-BASIC and all supporting prog & doc. \$1400. T. Bratcher, 1926 Woodslea, Apt 5, Flint MI 48507. (313) 744-3098 after 6 PM.

TRS-80 Horoscopes. Level 1 BASIC. Tutorial on horoscope and zodiac. Locates houses and planets. Any date 1800-2000. Single pass for 16K and three pass prog. for 4K. Both for \$7.50 (tape). D. L. Pitman, 3045 Tuna Canyon, Topanga CA 90290.

All prime, 100% guaranteed, in tubes. CD4030—25/\$7.50, CA3079—25/\$12, 74S112—25/\$10, 74116—15/\$15. A. Khan, 2355 Burch Cir. N.E., Atlanta GA 30319.

For Sale: GE capacitors 26,000 uF at 30 volts dc \$2 each or three for \$5. Postpaid U.S. only. L.F. Carbaugh, PO Box 398, New Cumberland PA 17070.

For Sale: Altair 8800B w/broken protect switch (bat handle was accidentally snapped off). Worked fine before the mishap. \$650. Jeff Smith, 5638 Whitsett #16, N. Hollywood CA 91607.

Sell: Heath H9 terminal, expertly assembled, \$550. 10 new DPI 8-in. disks, \$50. 1 ship. Andy Thornburg, 400 E. Jackson, DeSoto IL 62924.

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Apple II software—cassette: 16K blackjack—multicolor card display, 2-player paddle input, full Las Vegas rules, opt., auto-play by computer, sound effects, documentation incl., \$10. George W. Lee 18803 S. Christina Ave., Cerritos, CA 90701.

For Sale: Mits 88-ACR, 88-2SIO TTY, 8800A, 88-4MCS, 88-16MCS. ASR-33 TTY. 2 IBM 5440 hard disks. Must sell. High bidder takes any item. Michael Clark, R.D. #3, Nazareth PA 18064 (215) 759-6873.

TRS-80 Sort: in BASIC I, 4K min. Sorts recs in memory on 1 or 2 numeric fields in asc. or desc. seq. Input from tape, k.b. or both. Output to tape or video. Can be subroutine. \$10 on tape w/doc. To: Software, Box 6153, Syracuse NY 13217.

SWTP 6800/1 with 12K, serial control interface, parallel interface, documentation, in good condition, \$620. J. Wendel, 2 2nd St. NE, East Grand Forks MN 56721.

Struggling Artist/Programmer needs hard-copy graphics, digital or analog X-Y plotter. Write: Mitch Wade, 20221 Birch St., Santa Ana Heights CA 92707.

For Sale: North Star Software Special. Personal finance and budgeting package, \$15. Memory test, \$10, Diskopy, \$10. Both for \$15. Stock market analysis package, \$10. Correspondence editor, \$5. Mail list, \$5. Special assortment disk, \$10. Plus much more. Send blank disk or \$5.25 for disk. Write for complete list. Herb Schildt, 1007 N. Division, Urbana IL 61801.

GE opto-isolators H11A2, all prime. 100% guaranteed. With spec. 2/\$1., 100/\$40. A. Khan, 2355 Burch Cir. N.E., Atlanta GA 30319.

CIRCLE CHESS instruction book by Alphonso, used in Circle Chess software development. \$5. Stanonis, Box 63, Des Plaines IL 60017.

Poly & TRS-80 Software—New, Original. Send for complete list. Ted Carter, 902 Pinecrest, Richardson TX 75080. (214) 235-0915.

CORRECTIONS

Robert L. Smith of 2300 St. Francis Dr., Palo Alto CA 94303, writes:

"I have some information that may be of use to readers of the article, 'Super Terminal!' (March issue, p. 48), about the Burroughs/Friden 9350-2. There were some unidentified pins on Table 4 (and at least one pin in error). The identification should be as follows:

Pin No.	Function
24	SHIFT ENCODER #1
26	SHIFT ENCODER #2
27	BIT 6 OUT
28	PARITY BIT OUT
32	CONTROL BIT 6 OUT
33	CONTROL BIT 5 OUT
34	CONTROL PARITY BIT OUT
37	CONTROL BIT 7 OUT

Note that in Fig. 6, the missing pin is pin 27.

"It is not impossible to repair and modify the original boards, as I have done so, even before I obtained any original documentation. I did, however, have to generate a fair amount of documentation on my own.

"At least some of the ICs on the original circuit boards are apparently available from Raytheon. I have a limited supply of the various ICs (unused) if anyone is in need of them. I also have some used circuit boards and a fair amount of mechanical and electrical documentation for the 9350. However, I do not have any decent method for copying and distributing most of the documentation because of the large volume of the material."

Chris Kilgus of Phoenix AZ wrote to inform us that the ACIA in Fig. 1 of Don Gille's article "Tuned for Speed" (February issue, p. 59) is an MC 6850 rather than a 6820.

Our address was printed as Box 2485 in the "Mystery Program" in the April 1978 issue. It should be: Tom Rugg and Phil Feldman, PO Box 24815, Los Angeles CA 90024.

	1	2	3	4	5	6	7
	K	B					
8	9	10	11	12	13	14	15
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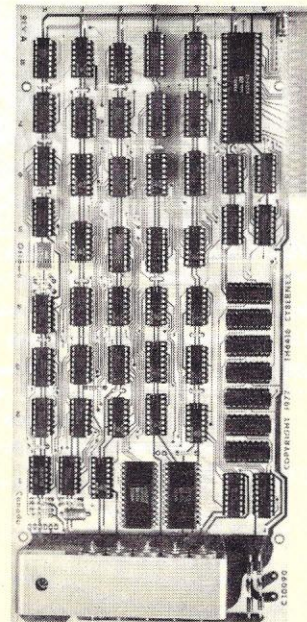
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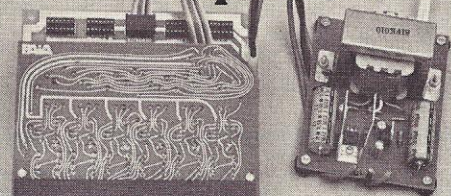
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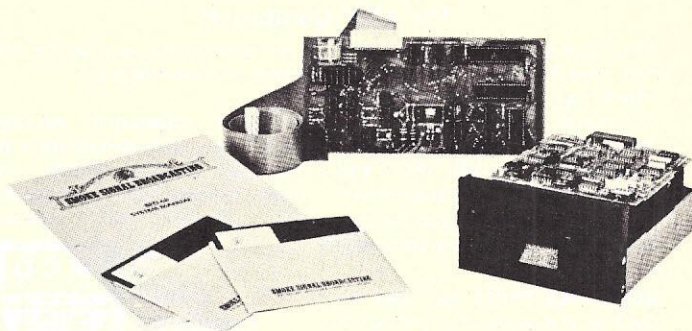


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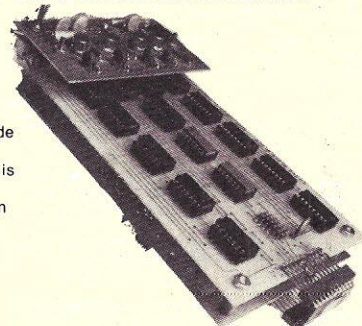
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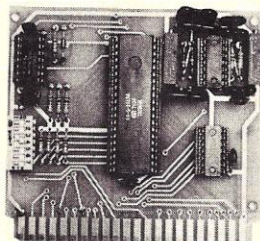
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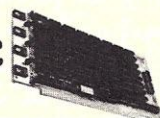


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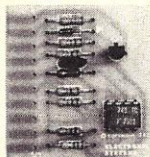
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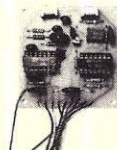


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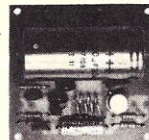
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- Works up to 1200 baud
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Apple II Serial I/O Interface *



Part No. 2

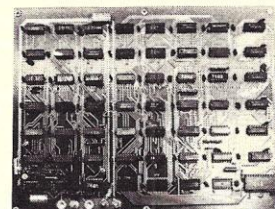
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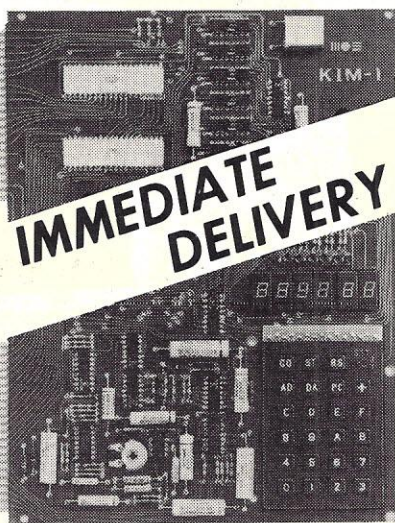
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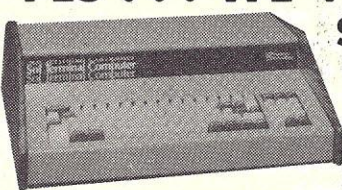
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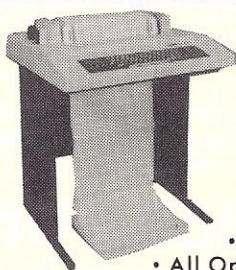
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SPECIFICATIONS:

Vertical Mode: CH1, CH2, CH1 & CH2 (Chopped) & CH1 & CH2 (Alt.)
The Following Specifications apply to each channel

Y Axis Vertical Input: 10mV/div to 50V in 12 Calibrated ranges, as follows:
x1-10mV/div to 10V/div in four ranges, each continuously variable.
x2-20mV/div to 20mV/div in four ranges, each continuously variable.
x5-50mV/div to 50mV/div in four ranges, each continuously variable.
Accuracy is 3%

Input Impedance: 1M ohm shunted by 50 pF.

Bandwidth: DC/DC to 15 Mhz ±6 db (DC to 8 Mhz ±3 db). AC, same as DC down to 3Hz.

Rise Time: Approximately 23 nS @ 1 division deflection.

Input Voltage: 250 maximum (DC and Peak AC).

Horizontal Mode: Internal Time Base or External Horizontal, switch selectable. In the XY mode, vertical input is through CH1 and horizontal input is through CH2

Bandwidth: DC to 200 KHz (±3 db).

Coupling: AC, DC or ground, switch selectable. Low frequency point on AC is 3 Hz.

Input Impedance: 1Meg ohm shunted by 50 pF.

Deflection Factor: 10mV/div to 50V/div in 12 calibrated ranges.
The ranges can be calibrated with the CH2 gain control 250V maximum (DC and Peak AC)

Input Voltage: 0.1uS/div to 0.5 Sec/div in 21' calibrated ranges, as follows:
x1, uS-0.1uS/div to 100 uS/div. x2, uS-0.2uS/div to 200 uS/div.
x5, uS-0.5uS/div to 500 uS/div. x1, mS-0.1mS/div to 100 mS/div.
x2, mS-0.2mS/div to 200 mS/div. x5, mS-0.5mS/div to 500 mS/div.
all in four ranges, each continuously variable. (Range increments ar .1, 1, 10, 100) With vernier in full clockwise position, calibrated time measurements are possible. Accuracy is 3%.

Triggering Internal: Sweep triggered from internal trigger source (In the dual trace modes, the internal trigger source is CH1).
Automatic: Trigger source is internal calibrator frequency. To be used if there is no other trigger source available to synchronize the sweep.

Line: Trigger is derived from line frequency when using the battery charger.

External: Controls function as for internal triggering (1 Megohm input impedance).
Slope: Selects sync to positive- or negative- going waveform.
Coupling: AC
Sensitivity: Less than 1 div for internal trigger and less than 1 volt for external trigger.

Level: Trigger Level control permits continuous adjustment of trigger point in all modes except Auto.

Internal Calibrator: A square-wave signal of 1 volt p-p ± 5% is provided. Frequency is approximately 1KHz.

Display Graticule: 4x5 div, each division is 0.25 inch. Viewing area 1.1"Hx1.35"W

CRT: Bluish-white phosphor, medium persistence. CRT uses low power filament for low battery drain. Instant on!

Power On-Board Batteries: Three sealed, rechargeable lead acid "D" Cells
Operating Time: Typically 4 hours.
Charging Time Scope Operating: Will run indefinitely but not reach full charge.

Non-operating: Sixteen hours.
External Power: Battery charger 115 vac (220 vac on request). 50-400Hz, less than 15 watts.
Dimensions: 3.1"Hx6.4"Wx8.0"D.

Weight: Three pounds.

Environment Operating Temperature: 0° to 40°C
Shock and Vibration: Designed to with stand normal shock and vibration encountered in commercial shipping and handling.

Accessories Furnished: Tilt stand, battery charger, 2 input cables, and 3 miniature banana plugs.
Optional: Leather carrying case and probes
Warranty: One year parts and labor. Made in the U.S.A.

MS-215 with Rechargeable Batteries and Charger \$395.00

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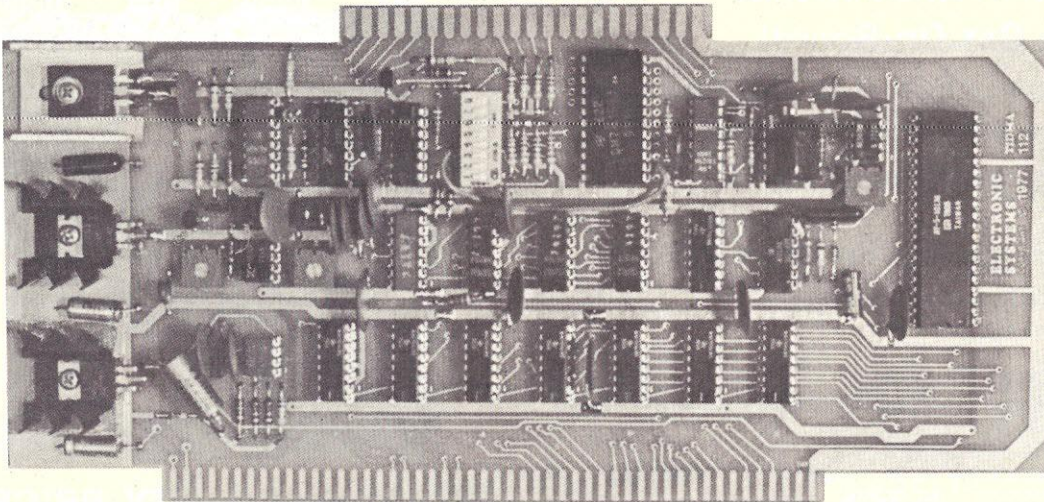


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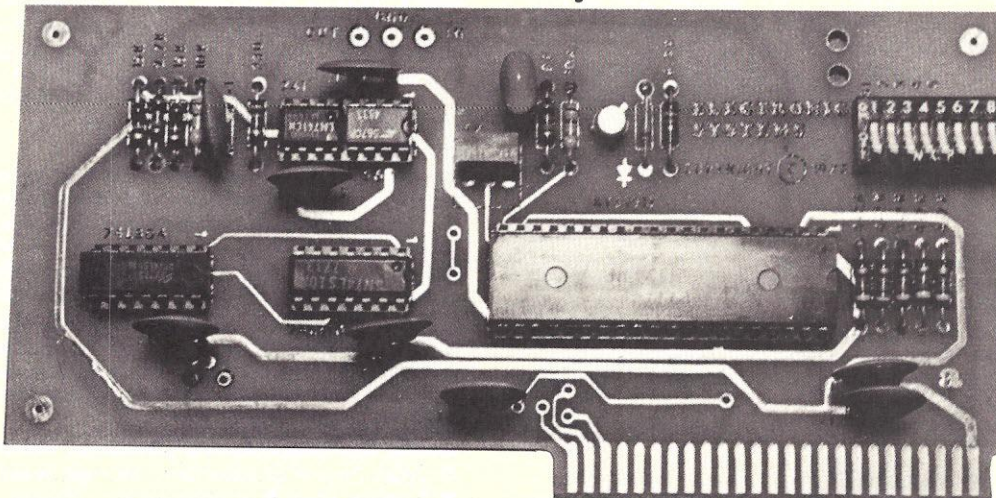
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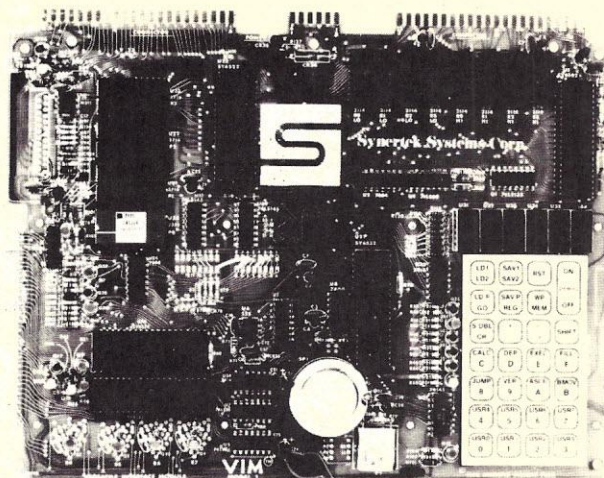
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Synertek has enhanced KIM-1* software as well as hardware. The software has simplified the user interface. The basic VIM-1 system is programmed in machine language. For those users who want to develop in assembly language directly on VIM-1 the optional RESIDENT ASSEMBLER/EDITOR can be purchased and plugged into the ROM/PROM expansion sockets ALREADY PROVIDED.

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- Carriage Return time is about 5 times longer than a standard terminal; therefore, you need to transmit up to 12 null or rubout characters after the standard CR/LF characters to allow enough time for the carriage return. This may require you to rewrite your computer's software. There are other characters which have similar problems such as Index, Tab, Backspace and Shift.
- The mechanics of the IBM Selectric limit the printing speed to a maximum of 14.9 characters per second, therefore it cannot run at 150 baud (15 characters/sec.)
- The standard baud rate for a Selectric is 134.5 and therefore cannot interface with a system having only the standard baud rates such as 110 or 150 without modifying or completely replacing the terminal's electronics.
- Some of the IBM Selectric terminals use a unique character ball and are *not* interchangeable with the standard typewriter ball. The balls for these are more expensive, harder to find, and do not have the font selection.
- The IBM Selectric's printer and keyboard are mechanically linked together and therefore, without sophisticated electronics, it cannot interface with a full-duplex system.
- The Selectric produces only 10 standard control codes versus 34 on a standard ASCII terminal.
- There are several IBM Selectric terminals around and *not all* have the heavy duty Selectric mechanism.

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 - B. As a Full 7-bit ASCII terminal at 110 Baud. With the following features;
 1. The terminal operates at 10 cps, but prints at 14.9 cps and has a 150 character buffer to compensate for the long carriage return time. Therefore there is no requirement to rewrite your computer's software.
 2. It generates all 34 of the standard ASCII control codes.
 3. Full or Half-duplex operation.
 4. Generation of parity.
 5. Two modes of operation:
 - a. TTY Mode: Transmits only upper-case codes (for alpha characters only) like a standard TTY even if the shift key is not depressed.
 - b. Typewriter Mode: Transmits both upper and lower-case codes, dependent upon the shift key being depressed or not.
- Has both RS-232 and 20 ma. Current Loop interfaces.
- Remote/Local switch, so it can be used as a typewriter or a terminal.
- Uses the standard IBM Selectric character ball.
- Has a 15" carriage for up to 132 characters per line.
- Platen feed.

● ALLOW 6 TO 8 WEEKS FOR DELIVERY ● PRICE INCLUDES FULL DOCUMENTATION ● 30 DAY WARRANTY—PARTS AND LABOR

Terminals only, select: ☐ Airfreight ☐ Surface **TERMINALS SHIPPED FREIGHT COLLECT—FOB Phoenix AZ**
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Enclosed: ☐ check ☐ M.O. Charge ☐ VISA ☐ Master Charge

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Expiration date: _____ Signature: _____

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S.D. COMPUTER PRODUCTS

AN EMPIRE IND. CO.

P.O. BOX 28810K

DALLAS, TEXAS 75228

EXPANDABLE EPROM BOARD

16K OR 32K EPROM \$49.95 W/OUT EPROM
Allows You to Use Either 2708's For 16K of Eprom or 2716's For 32K of Eprom.

KIT FEATURES:

1. All Address Lines & Data Buffered
2. Quality Plated through P.C. Board Including Solder Mask and Silk Screen
3. Selectable Unit States
4. On Board Regulation Provided
5. All Sockets Provided W/Board

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4K LOW POWER RAM KIT The Whole Works - \$79.95

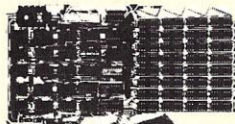
Full Buffered - on board regulated - reduced power consumption utilizing low power 21L02-1 500ns RAMS - Sockets provided for all IC's. Quality plated through PC board.



*Add \$10.00 for 250ns RAM operation.

EXPANDORAM THE ULTIMATE RAM BOARD 32K FOR \$475.00

32K MODEL	
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16K259.00
24K387.00
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64K995.00

THE 32K VERSION USES THE MOSTEK MK4115 RAM AND HAS 8K BOUNDARIES AND PROTECTION & UTILIZES DIP SWITCHES. P.C. BOARD COMES WITH SOCKETS FOR 32K OPERATION

BUY A \$100 COMPATIBLE RAM BOARD AND UPGRADE THE SAME BOARD TO A MAXIMUM OF 65K MEMORY IN STEPS OF EITHER 8K OR 16K AT YOUR OPTION BY MERELY PURCHASING MORE RAM CHIPS FROM S.D. COMPUTER PRODUCTS.

THE 64K VERSION USES THE MOSTEK MK4116 RAM AND HAS 16K BOUNDARIES AND PROTECTION & UTILIZES DIP SWITCHES. P.C. BOARD COMES WITH SOCKETS FOR 64K OPERATION

LOOK AT THE FEATURES WE HAVE BUILT INTO THE EXPANDORAM!

- MEMORY ACCESS TIME IS 375 ns
- MEMORY CYCLE TIME IS 500 ns
- POWER REQUIREMENTS ARE:
 - 8 VDC 400 MA DC
 - 18 VDC 400 MA DC
 - 18 VDC 30 MA DC
- ON BOARD INVISIBLE REFRESH
- NO WAIT STATES REQUIRED
- NO CYCLE STEALING NEEDED
- ON BOARD REGULATION
- CONTROL, DATA & ADDRESS INPUTS UTILIZE LOW POWER SCHOTTKY DEVICES
- DESIGNED TO WORK WITH Z-80, 8080, 8085, CPU's

ADD \$50.00 TO ABOVE PRICES FOR FULLY ASSEMBLED AND TESTED BOARDS

Low Cost Cassette Interface Kit \$19.95



Features: Play and record K.C. Standard 2400/1200 Hz tapes, 300 Baud, TTL I/O Compatible, Phase Lock Loop, Both 22 Pin Connector and 8 Pin Molex Connector. Comes partially assembled. Oscillator and phase lock loop pre-tuned to K.C. Standard. Selector switch sends cassette data or auxiliary input data to microprocessor. LED indicates logic 1 level.

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FULLY ASSEMBLED AND TESTED. NOT A KIT. Insal - Altair - S-100 Bus compatible, uses low power static 21L02-500ns fully buffered on board regulated, quality plated through PC board, including solder mask. 8 pos. dip switches for address select.

*Add \$30.00 for 250ns RAM operation



Z-80 CPU BOARD KIT Complete Kit \$139.

CHECK THE ADVANCED FEATURES OF OUR Z-80 CPU BOARD: Expanded set of 158 instructions, 8080A software capability, operation from a single 5VDC power supply; always stops on an M1 state, true sync generated on card (a real plus feature!), dynamic refresh and NMI available, either 2MHZ or 4MHZ operation, quality double sided plated through PC board; parts plus sockets provided for all IC's.



*Add \$10. extra for Z-80A chip which allows 4MHZ operation.

NEW FROM S.D. "VERSAFLOPPY"™ KIT THE VERSATILE FLOPPY DISK CONTROLLER ONLY \$149.00

FEATURES: IBM 3740 Soft-Sector Compatible, S-100 BUS Compatible for Z-80 or 8080. Controls up to 4 Drives (single or double sided). Directly controls the following drives:

1. Shugart SA400/450 Mini Floppy
2. Shugart SA800/850 Standard Floppy.
3. PERCISI 70 and 277.
4. MFE 700/750.
5. CDC 9404/9406.

34 Pin Connector for Mini Floppy, 50 Pin Connector for Standard Floppy. Operates with modified CP/M operating system and C-Basic Compiler. The new "Versafloppy" from S.D. Computer Products provides complete control for many of the available Floppy Disk Drives, Both Mini and Full Size. FD1771B-1 Single Density Controller Chip. Listings for Control Software are included in price.

FD 1771B-1 CHIP ALONE \$39.95

Z80 STARTER KIT

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SIMPLE, STEP BY STEP LEARNING. CONSTRUCTION, PROGRAMMING, OPERATION, MEMORIES, INTERFACING, COMPUTING, AND CONTROLLING WITH AUDIO CASSETTE INTERFACE CAPABILITIES.

Complete Kit includes: Key board and Display; Z80 Central Processing Unit; Instructions; Operation Manual; Learning Guides.

Features: Powerful Z80 CPU with 158 instructions • 1024 Bytes (Expandable to 2048 Bytes ON BOARD) of RAM • 2 Bi-Directional Input/Output Ports with Handshaking • Kansas City Standard Audio Cassette Interface for Program Storage • Hexadecimal Keyboard and Display • Wirewrap area for custom circuitry • S-100 Connector on board for Memory and I/O Expansion • 2716/2758 PROM Programmer • "Z-BUG" Monitor ROM (including: Memory, Port and Register Examine and Change Commands; Breakpoints; Single Step Capability; Audio Tape Load and Dump; Execute user program Commands.)

Many more unique features. The best computer educational kit on the market... the complete computer and educational package for only \$199.00. (Available June 1978).

INTRODUCING THE SBC-100 (The Z-80 Based, S-100 Single Board Computer)

\$349.00

FEATURES:

- No Front Panel Needed
- Z-80 CPU (2 or 4 MHz)
- 1K RAM
- 4 ROM/PROM Sockets for 4K/8K of Memory
- SYNCHRONOUS/ASYNCHRONOUS Serial I/O with RS-232 and Current Loop Interface and Software
- Programmable Baud Rate
- Parallel Input Port
- Parallel Output Port
- 4 Channel Timer/Counter
- 4 Vectored Interrupts

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ASK ABOUT SPECIAL O.E.M. DISCOUNTS ON THE S.D. "COMPATIBLE SET."

SBC-100 — SINGLE BOARD COMPUTER	\$349.00
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EXPANDORAM — 32K RAM	\$475.00
EACH KIT IF PURCHASED SEPARATELY TOTAL	\$973.00
ORDER ALL 3 KITS TOGETHER FOR	\$899.00

This Powerful Threesome Operates Together to Form A Complete Computer for Your System.

Z-80 Programming Manual

IN DEPTH DETAIL OF THE Z-80 CPU MICRO-COMPUTER

S. D. SALES SPECIAL \$9.95

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21L02 - 500NS	8/11.50
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1702A - 1K - 1.5us	3.95 or 10/35.
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MK50397 6 Digit elapsed timer	8.95
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S.D. NOW HAS SOFTWARE FOR IT'S CUSTOMERS

CP/M® DISK OPERATING SYSTEM . . . \$99.95

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Runs on ANY CP/M based disk system. Assembles the official Zilog-Mostek Mnemonics. Contains extensive set of pseudo-ops. Available on mini or full size diskette.

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Provides control for VERSAFLOPPY and boots up CP/M. This runs on Z-80, 8080 or 8085 based computers. Available in 2708 or 2758 prom.

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Powerful monitor for SBC-100 single board computers. Includes all VERSAFLOPPY control firmware. Comes in 2716 prom. Available in 4-6 weeks.

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S. D. SALES' VERSAFLOPPY S-100 CONTROLLER BOARD PLUS SHUGART SA 400 FLOPPY DISK DRIVE INCLUDING CABLE FOR ONLY

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8224 — Clock Gen.	4.95
8225 — Invert Bus	3.95
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8228 Sys. Controller	8.20
8251 Prog. comm. interf.	10.95
8255 prog. prep. interface	13.50
8820 Dual Line Recv.	1.75
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8838 Quad Bus. Recv.	2.00
74LS138N — 1/8 decoder	9.99
8797-Hex Tri-State Buffer	1.25
1488/1489 RS232	1.50
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TR 1863 Uart	8.50
FD 1771B-1	39.95

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4001	19	4029	99
4002	19	4042	69
4011	19	4047	1.50
4013	32	4049	35
4016	32	4069	23
4017	95	4071	19
4020	97	4076	97
4022	97	14518	1.10
4024	75	14528	85
4027	39	14529	85

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SC-5 With Rechargeable Batteries & Charger Unit **\$89**

FM-7 With Rechargeable Batteries & Charger Unit **\$195**

Features include: • By using the new NLS SC-5 Prescaler, the range of the FM-7 Frequency Meter, which is 10 Hz to 60 MHz, may be extended to 512 MHz (the upper VHF & UHF frequency bands). • The FM-7 utilizes an LED readout, providing 7-digit resolution. • The FM-7 can be calibrated to an accuracy of 0.00001%. • The SC-5 is accurate to one part per million. • Each unit has 30 millivolts sensitivity, is battery powered and has a charger unit included. • Dimensions of each are 1.9" H x 2.7" W x 3.9" D. • The units may be obtained separately or as a "Frequency Duo." • Parts & Labor guaranteed 1 year.

Tilt stand option..... **\$3.50**
Leather case..... **\$16.00**

MS-15 MINISCOPE \$289

With Rechargeable Batteries & Charger Unit



- 15 megahertz bandwidth.
- External and internal trigger.
- Time base — .1 microsec. to 0.5 Sec/div - 21 settings ± 3%.
- Battery or line operation.
- Automatic & line sync modes.
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- Case size 2.7"H x 6.4"W x 7.5"D, 3 pounds.
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- 10 to 1, 10 meg probe..... **\$24.50**
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NEW VOLKSMETERS!

With LCD Display—Excellent Readability in Direct Sunlight!



NEW
LM-300
Full three digits
\$99.50*

**0.5%
LM-350**
3 1/2 digits
\$125.00*

FEATURES

- Measures DC volts, AC volts, ohms and current.
- Automatic polarity, decimal and overload indication.
- No zero adjustment and no full scale ohms adjust.
- Large LCD display for easy reading without interpolation.
- Size: 1.9" H x 2.7" W x 4.0" D.
- Parts and labor guaranteed for one year.

SPECIAL!!

Batteries & Charger: **\$1.00**
with the purchase of Meter and the mention of this magazine.

Standard AA-size batteries provide up to 20 hours of operation. Rechargeable NiCad batteries and charger unit available as optional equipment. *Batteries not included.

SPECIFICATIONS					
MODE	RANGE	ACCURACY LM-300	ACCURACY LM-350	RESOLUTION	INPUT RESISTANCE
VOLTS DC	1	±1% Reading†	±0.1% Reading†	1 mV	10 MΩ
	10			10 mV	
	100			100 mV	
VOLTS AC	1	±1% Reading†	±0.1% Reading†	1 mV	10 MΩ, 20 pF
	10			10 mV	
	100			100 mV	
OHMS	1	±1% Reading†	±0.1% Reading†	1 Ω	
	10			10 Ω	
	100			100 Ω	
CURRENT	1 mA	±2% Reading†	±0.1% Reading†	1 μA	10 MΩ
	10 mA			10 μA	
	1 A			100 μA	

* 1000 volt or peak or maximum any range. † ±2 Digits
† True Voltage Class 1 volt Full Scale = 1.50 volt, 2 volt Full Scale = 1.50 volt
* LM-350 has 1000 volt range - full scale readings are 1.999, 19.99, etc.

Tilt Stand Option, add **\$3.50**
Leather Case **\$16.00**
3AA NiCad-Batts. & Charger **\$12.00**

LEDU MG 10A
List \$72.00

Perfectly balanced, fluorescent lighting with precision magnifier lens. For profi, techn & hobbyist. Has cast protective shade, inst. start 3 dioptr lens. 42" reach.

\$44.95
with T-8 fluorescent lamp (included)
colors: Gray or Black
checkmate finish
2 choices please

SPECIAL

8803 MOTHER BOARD FOR 100 BUS MICRO-COMPUTERS

• Kit includes 12 tantalum capacitors for +5, +12, -12 buses and insulated mounting spacers.
• Wiring side shown. Component side bare epoxy glass with white markings for component locations.
• 610 epoxy glass board with 2 ounce copper, solder plated and .038 diameter holes for leads.
• Solder mask with solder windows on etched circuits to avoid accidental short circuits.
• Mounts 11 receptacles with 100 contacts (2 rows) on .125 centers with .250 row spacing. Vector part number R681-2, or mounts 10 receptacles plus interconnections to smaller mother board for expansion.
• Includes etched circuits and instructions for option of active, pull-up, or floating terminations.
• Large buffers +5V and GND (10 AMP) ± 12V or 16V (1 AMP). Current ratings are per MIL-STD-275 with 10°C rise.
• Fits in Vector 8800 microcomputer as expander board.

Price: \$29.50

Vector Plugboards

8800V Universal Microcomputer/processor plugboard, use with S-100 bus. Complete with heat sink & hardware. 5.3" x 10" x 1/16"

1-4 \$19.95 5-9 \$17.95 10-24 \$15.95

8801-1 Same as 8800V except plain; less power buses & heat sink

1-4 \$14.95 5-9 \$13.45 10-24 \$11.95

3682 9.6" x 4.5" \$10.97
3682-2 6.5" x 4.5" \$9.81

Hi-Density Dual-In-Line Plugboard for Wire Wrap with Power & Grd. Bus Epoxy Glass 1/16" 44 pin con. spaced .156

3677 9.6" x 4.5" \$10.90
3677-2 6.5" x 4.5" \$9.74

Gen. Purpose D.I.P. Boards with Bus Pattern for Solder or Wire Wrap. Epoxy Glass 1/16" 44 pin con. spaced .156

3662 6.5" x 4.5" \$7.65
3662-2 9.6" x 4.5" \$11.45

P pattern plugboards for IC's Epoxy Glass 1/16" 44 pin con. spaced .156

R644 P.C. receptacle 22/44 cont. 156 ctrs. pierced solder eyelets tails gold **\$2.95**
R644-3 P.C. receptacle 22/44 cont. 156 ctrs. Wire Wrap tails gold **\$4.49**

S-100 Bus P.C. Edge Connectors
R681 DIP solder tails on 140" spaced leads for ALTAIR mother boards. Fits .042" dia. holes, gold **\$7.35**
R681-1 .025" sq. 3 wrap lengths posts (.62 long) on .250 spaced rows, gold **\$5.00**
R681-2 .025" sq. 1 wrap length posts (.22 long) on .250 spaced rows for wrapping or DIP solder for IMSAI mother boards, gold **\$5.85**
R681-3 pierced solder eyelet tails, gold **\$7.35**

1/16" Vector BOARD
.042 dia holes on .01 spacing for IC's

Phenolic

PART NO.	SIZE	PRICE
64P44-062XXP	4.5 x 6.5"	\$1.49
169P44-062XXP	4.5 x 17"	\$3.51

Epoxy Glass

PART NO.	SIZE	PRICE
64P44-062	4.5 x 6.5"	\$1.70
84P44-062	4.5 x 8.5"	\$2.10
169P44-062	4.5 x 17"	\$4.30
169P84-062	8.5 x 17"	\$6.39

SLIT-N-WRAP
Wraps insulated wire on .025" square posts **FOUR TIMES FASTER** than regular manual wrap-post tools

P180 with two 100' spools of 28 ga. wire **\$75.00**

P160-4T includes charger, wire **\$75.00**

SLIT-N-WRAP WIRE NO. 28 GAGE INSULATED WIRE, 100' SPOOLS
W28-2-A-Pkg. 3, Green W28-2-C-Pkg. 3, Clear W28-2-B-Pkg. 3, Red W28-2-D-Pkg. 3, Blue

2708 8K 450 ns

EPROM FACTORY PRIME
\$10.00 EA.
25 + Call For Price

14 & 16 PIN 3 LEVEL WIRE WRAP SOCKETS

	14-T3 100 for	16-T3 100 for
	\$30.00	\$30.00
50 of ea. for	\$32.00	

ACE • All- for fast, solderless, Circuit plug-in circuit building Evaluator and testing

Just plug in any components with leads to .032" dia. Interconnect with solid wire up to 20 ga. Assembled models too!

ACI Model No.	Trs	Ports	Size (inches)	Price
200-K (KIT)	728	8 (16's)	2 1/2 x 4 1/2 x 5 1/2	\$19.95
208 (assem.)	872	8 (16's)	2 1/2 x 4 1/2 x 5 1/2	28.95
201-K (KIT)	1032	12 (14's)	2 1/2 x 6 x 7	24.95
212 (assem.)	1224	12 (14's)	2 1/2 x 6 x 7	34.95
218 (assem.)	1760	18 (14's)	2 1/2 x 6 1/2 x 7 1/8	46.95
227 (assem.)	2712	27 (14's)	2 1/2 x 8 x 9 1/4	59.95
236 (assem.)	3648	36 (14's)	3 1/2 x 10 1/4 x 9 1/4	79.95

Gold plated aluminum base/ground; non-conductive nickel-silver terminals; 4 rubber feet.

LIQUID CRYSTAL DIGITAL CLOCK-CALENDAR

- For Auto, Home, Office
- Small in size (2x2 1/2 x 1 1/2)
- Push button for seconds release for date.
- Clocks mount anywhere with either 3M double-sided tape or VELCRO, included.
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LCD-101, portable model runs on self-contained batteries for better than a year.
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- LCD-101 or LCD-102 your choice..... **\$34.95..**
- Clear desk stand for..... **\$2.00**

3 LEVEL GOLD WIRE WRAP SOCKETS

	1-24	25-49	50-99
8 pin	.47	.42	.37
10 pin	.45	.41	.37
14 pin	.39	.38	.37
16 pin	.43	.42	.40
18 pin	.75	.68	.62
20 pin	.84	.77	.71
22 pin	1.00	.97	.95
24 pin	1.00	.94	.75
28 pin	1.09	.98	.84
36 pin	1.59	1.45	1.30
40 pin	1.49	1.39	1.29

MICRO-KLIP for .042 dia. holes (all boards on this page)
T42-1 pkg. 100 \$1.50
T42-1 pkg. 1000 \$11.00
P-149 hand installing tool \$2.03

8" LED ALARM CLOCK
12 hr. LED Alarm Clock uses 3 1/2 digit 8" LED Display with AM/PM indicators and colons. Direct Drive. PIN to PIN interface with **ST998A** I.C. Just add switches, AC Supply Alarm. Display and I.C. only.

\$7.95 or 2/\$15.00

Price Breakthrough! \$17.95

MA1003 CAR CLOCK

Bright Green Fluorescent Display Crystal Time Base Assembled, just add switches and 12 VDC.

SPECIAL
14CS2 100 for \$14.95
16CS2 100 for \$16.95
14 pin CS2 100 for \$2.95
16 pin CS2 8 for \$2.95

These low cost DIP sockets will accept both standard width plugs and chips. For use with chips, the sockets offer a low profile height of only .125" above the board. These sockets are end stackable.

Vector WRAP POST for .042 dia. holes (all boards on this page)
T-44 pkg. 100 \$2.28
T-44 pkg. 1000 \$14.00
A-13 hand installing tool \$2.80

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Terms: VISA, MC, BAC, check, Money Order, C.O.D., U.S. Funds Only. CA residents add 6% sales tax. Minimum order \$10.00. Orders less than \$75.00 include 10% shipping and handling; excess refunded. Just in case please include your phone no. "Sorry, no over the counter sales" Good thru July 15, 1978

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24 PIN DIP PLUGS WITH COVERS
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MINISCOPE \$289.00 MS-15 MINISCOPE \$289.00 NLS

NLS MS-15 MINISCOPE \$289.00 NLS MS-15 MINISCOPE \$289.00

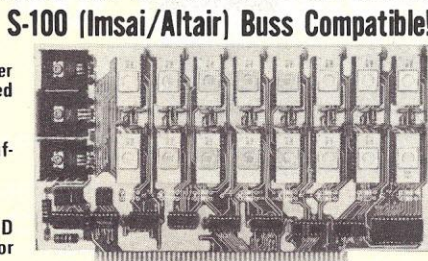
New!

16K E-PROM CARD

IMAGINE HAVING 16K OF SOFTWARE ON LINE AT ALL TIME!

KIT FEATURES:

1. Double sided PC board with solder mask and silk screen and gold plated contact fingers.
 2. Selectable wait states.
 3. All address lines & data lines buffered!
 4. All sockets included.
 5. On card regulators.
- KIT INCLUDES ALL PARTS AND SOCKETS (except 2708's). Add \$25. for assembled and tested.



PRICE CUT!

\$57.50 kit

WAS \$69.95

SPECIAL OFFER:

Our 2708's (450NS) are \$12.95 when purchased with above kit.

Fully Static!

KIT FEATURES:

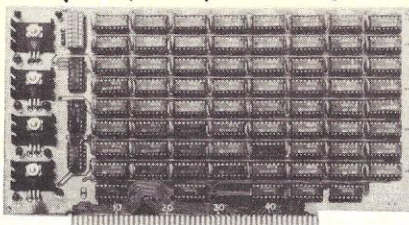
1. Doubled sided PC Board with solder mask and silk screen layout. Gold plated contact fingers.
2. All sockets included.
3. Fully buffered on all address and data lines.
4. Phantom is jumper selectable to pin 67.
5. FOUR 7805 regulators are provided on card.

ADD
\$20 FOR
250NS

8K LOW POWER RAM KIT - \$149.00

S-100 (Imsai/Altair) Buss Compatible!

2 KITS FOR \$279



USES 21L02 RAM'S!

Fully Assembled & Burned In
\$179.00

Blank PC Board w/ Documentation
\$29.95

Low Profile Socket Set 13.50
Support IC's (TTL & Regulators)
\$9.75

Bypass CAP's (Disc & Tantalums)
\$4.50

MOTOROLA QUAD OP - AMP
MC 3401. PIN FOR PIN SUB.
FOR POPULAR LM 3900.

3 FOR \$1

ALARM CLOCK CHIP
N.S. MM5375AA. Six Digits.
With full Data. **New!**
\$1.95 each

FULL WAVE BRIDGE
4 AMP. 200 PIV.
69¢ 10 FOR \$5.75

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RESEARCH OF CALIFORNIA, THE
SUPPLIERS OF CPM SOFTWARE.

MOTOROLA 7805R VOLTAGE REGULATOR
Same as standard 7805 except 750 MA output.
TO-220. 5VDC output.
44¢ each or 10 for \$3.95

450 NS! 2708 EPROMS
Now full speed! Prime new units from a major U.S. Mfg. 450 N.S.
Access time. 1K x 8. Equiv. to 4-1702 A's in one package.
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A major U.S. computer mfg. installed thousands of these 4K Motorola RAM's on the wrong boards and had to remove them. All parts were then tested, and met **FULL SPECS!** If you don't mind a little solder on the leads, then this is the best memory buy in the world. Arranged as 4096 x 1 Bits. 470 NS. The Motorola 6605 is one of the easiest dynamic RAM's to use since it DOES NOT require multiplexed addresses as do most other 4K's such as the 4096 or 4027. A complete memory board design using the 6605 is outlined in the Motorola M6800 Applications Manual starting on page 4-70.

99¢ EACH
(WITH DATA SHEET)

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By Mostek, The major Z-80 second source. The most detailed explanation ever on the working of the Z-80 CPU CHIPS. At least one full page on each of the 158 Z-80 instructions. A MUST reference manual for any user of the Z-80. 300 pages. Just off the press. \$12.95

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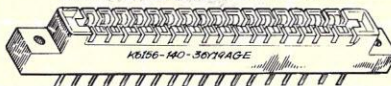


1500 MFD. 16 WVDC.
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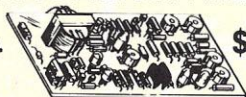
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RCA TRIAC #2

#40536. Rated 3 AMP 400 PIV.
TO-5 Case Mounted on Heatsink.

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1 OHM 15W. 5%

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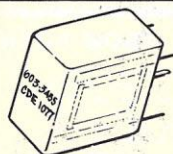
3.16 OHM 2W. 5%

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More Tantalum Caps

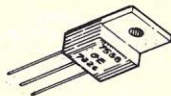
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SPDT. Coil is 280 ohm.
Small Size. \$1.29

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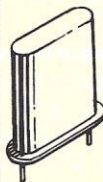
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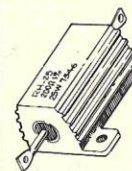
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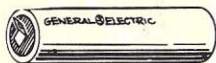
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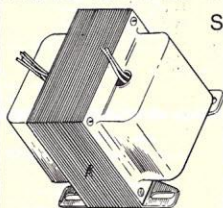
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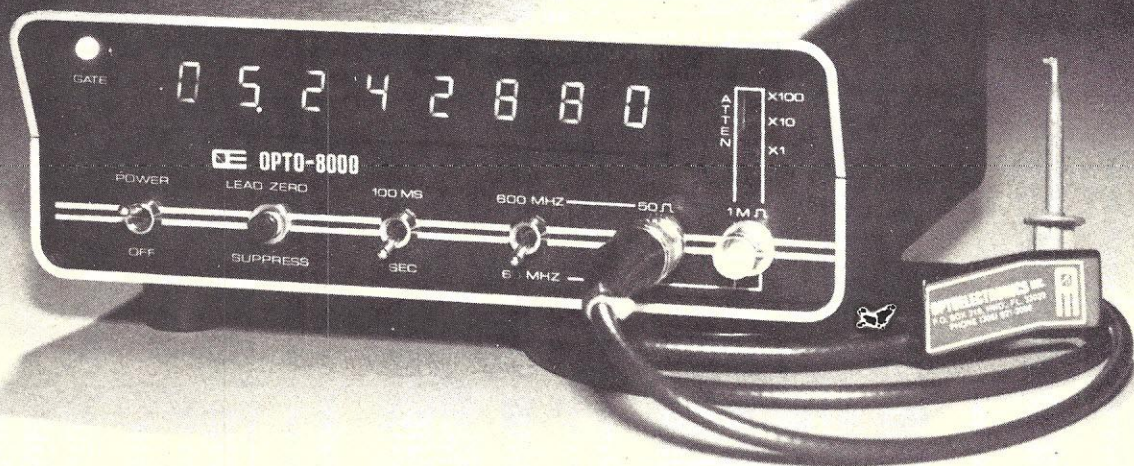
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D20

600 MHZ. FREQUENCY COUNTER

±0.1 PPM TCXO

OPTO-8000.1



This new instrument has taken a giant step in front of the multitude of counters now available. The Opto-8000.1 boasts a combination of features and specifications not found in units costing several times its price. Accuracy of ± 0.1 PPM or better — *Guaranteed* — with a factory-adjusted, sealed TCXO (Temperature Compensated Xtal Oscillator). **Even kits require no adjustment for guaranteed accuracy!** Built-in, selectable-step attenuator, rugged and attractive, black anodized aluminum case (.090" thick aluminum) with tilt bail. 50 Ohm and 1 Megohm inputs, both with amplifier circuits for super sensitivity and both diode/overload protected. Front panel includes "Lead Zero Blanking Control" and a gate period indicator LED. AC and DC power cords with plugs included.

SPECIFICATIONS:

Time Base—TCXO ± 0.1 PPM GUARANTEED!
 Frequency Range—10 Hz to 600 MHz
 Resolution—1 Hz to 60 MHz; 10 Hz to 600 MHz
 Decimal Point—Automatic
 All IC's socketed (kits and factory-wired)
 Display—8 digit LED
 Gate Times—1 second and 1/10 second
 Selectable Input Attenuation—X1, X10, X100
 Input Connectors Type—BNC
 Approximate Size—3" h x 7 1/2" w x 6 1/2" d
 Approximate Weight—2 1/2 pounds
 Cabinet—black anodized aluminum (.090" thickness)
 Input Power—9-15 VDC, 115 VAC 50/60 Hz
 or internal batteries
 OPTO-8000.1 Factory Wired **\$299.95**
 OPTO-8000.1K Kit **\$249.95**

ACCESSORIES:

Battery-Pack Option—Internal Ni-Cad Batteries and charging unit **\$19.95**
 Probes: P-100—DC Probe, may also be used with scope **\$13.95**
 P-101—LO-Pass Probe, very useful at audio frequencies **\$16.95**
 P-102—High Impedance Probe, ideal general purpose usage **\$16.95**

VHF RF Pick-Up Antenna-Rubber Duck w/BNC #Duck-4H **\$12.50**
 Right Angle BNC adapter #RA-BNC **\$ 2.95**

FC-50 — Opto-8000 Conversion Kits:

Owners of FC-50 counters with #PSL-650 Prescaler can use this kit to convert their units to the Opto-8000 style case, including most of the features.

FC-50 — Opto-8000	Kit \$59.95
*FC-50 — Opto-8000F	Factory Update \$99.95
FC-50 — Opto-8000.1 (w/TCXO)	Kit \$109.95
*FC-50 — Opto-8000.1F	Factory Update \$149.95

*Units returned for factory update must be completely assembled and operational



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SOCKET JUMPERS

Mates with two rows of .025" sq. or dia. posts on patterns of .100" centers and shielded receptacles. Probe access holes in back. Choice of 6" or 18" length.

Part No.	No. of Contacts	Length	Price
924003-18R	26	18"	\$ 5.38 ea.
924003-06R	26	6"	4.78 ea.
924005-18R	40	18"	8.27 ea.
924005-06R	40	6"	7.33 ea.
924006-18R	50	18"	10.31 ea.
924006-06R	50	6"	9.15 ea.

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Solder to PC boards for instant plug-in access via socket-connector jumpers. .025" sq. posts. Choice of straight or right angle.

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923873-R	26	right angle	1.52 ea.
923865-R	40	straight	1.94 ea.
923875-R	40	right angle	2.30 ea.
923866-R	50	straight	2.36 ea.
923876-R	50	right angle	2.82 ea.

INTRA-CONNECTOR

Provides both straight and right angle functions. Mates with standard .10" x .10" dual row connectors (i.e. 3m, Ainsley, etc.) Permits quick testing of inaccessible lines.

Part No.	No. of contacts	Price
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INTRA-SWITCH

Permits instant line-by-line switching for diagnostic or QA testing. Switches actuated with pencil or probe tip. Mates with standard .10" x .10" dual-row connectors. Low profile design. Switch buttons recessed to eliminate accidental switching.

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




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THESE FREQUENCIES ONLY

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CY3A	4.000MHz	HC18	4.95
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CY5.18	5.185MHz	HC18	4.95
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CY19A	18.000MHz	HC18	4.95
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1/4" mounting holes

SWITCHES

	TOGGLE (sub-miniature)	JMT121	SPDT	on-off-on	\$1.95	\$1.43
		JMT123	SPDT	on-none-on	1.65	1.21
		JMT221	DPDT	on-off-on	2.55	1.87
		JMT223	DPDT	on-off-on	2.15	1.58
	TOGGLE (Printed Circuit)	MPC121	SPDT	on-off-on	\$2.05	\$1.53
		MPC123	SPDT	on-none-on	1.75	1.31
		MPC221	DPDT	on-off-on	2.65	1.97
		MPC223	DPDT	on-off-on	2.25	1.68
	PUSH BUTTON	PB123	SPDT	maintained	1.95	1.47
		PB126	SPDT	momentary	1.95	1.47
	PUSH BUTTON Miniature	MS102	DPST	momentary open	.35	.30
		MS103	DPST	momentary closed	.35	.30
	DIPSWITCH SPST	206-4	8 pin dip	4 switch	1.75	1.65
		206-7	14 pin dip	7 switch	1.95	1.85
		206-8	16 pin dip	8 switch	2.25	2.15

1/16 VECTOR BOARD

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64P44 062XXXP	4.50	17.00	3.69	3.32
64P44 062WE	4.50	6.50	2.07	1.86
64P44 062WE	4.50	8.50	2.56	2.31
64P44 062WE	4.50	17.00	5.04	4.53
64P44 062WE	8.50	17.00	9.23	8.26
64P44 062WEC1	4.50	17.00	6.80	6.12

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Model P180 includes 2-100' spools #28 AWG wire wrap wire

Supplies insulated wire from spool to wrap-posts without prestripping and precutting using "daisy chain" method.

Model P180

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for P180 Slit N Wrap	wire for P180 #28 AWG
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	W28-2-A (green) W28-2-B red
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Injection molded unit. Complete with red bezel. 4 1/2" x 4" x 1-9/16"

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8216 Bi-Directional Bus Driver	4.95	MC6821 Periph. Interface Adapter	11.50
8224 Clock Generator/Driver	5.95	MC6830L8 1024 X 8 Bit ROM	14.95
System Controller/Bus Driver	5.95	MC6850 Asynchronous Comm. Adapter	14.95

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1802M COP1802 Manual	\$ 7.50	1101 256 X 1 Static	\$ 1.49
280M 280 Manual	7.50	1024 X 1 Dynamic	.99
2650M 2650 Manual	5.00	2101 256 X 4 Static	5.95
		2102 1024 X 1 Static	1.75
		2107/5280 4096 X 1 Dynamic	4.95

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MM500H Dual 25 Bit Dynamic	.50	2111 256 X 4 Static	5.95
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MM507H Dual 100 Bit Static	.50	2114L-3 4K X 1 Static 300ns Low Power	11.95
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MM513N 1024 Bit Accumulator Dynamic	2.95	8101 256 X 4 Static	6.95
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MM5017N Dual 500/512 Bit Dynamic	2.95	8599 16 X 4 Static	3.49
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2518 Hex 32 Bit Static	4.95	74200 256 X 1 Static	6.95
2519 Hex 40 Bit Static	9.95	93421 256 X 1 Static	2.95
2522 Dual 132 Bit Static	2.95	MM5262 2K X 1 Dynamic	.49
2524 512 Dynamic	2.95	MM4027 (UPD414) 4K DYNAMIC 16 PIN	5.95
2525 1024 Dynamic	2.95	MM4116 (UPD416) 16K DYNAMIC 16 PIN	29.95
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2532 Dual 80 Bit Static	2.95		
2533 1024 Static	6.95		
3341 F16	1.95		
74LS670 4 X 4 Register	6.95		

ROM'S

2513(2140) Character Generator (upper case)	\$ 9.95	2716 T.J.	8K EPROM
2513(3021) Character Generator (lower case)	9.95	2716 Intel	16K EPROM
2516 Character Generator	10.95	6301-1	256 Open C Bipolar
MM5230N 2048 Bit Read Only Memory	1.95	74188 512 TTL Open Collector	2.95
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AY-5-1013 30K BAUD	\$ 5.95		
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\$229.00/kit

- Analyzes any type of digital system
- Checks data rates in excess of 8 million words per second
- Trouble shoot TTL, CMOS, DTL, RTL, Schottky and MOS families
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- See ones and zeros displayed on your CRT, octal or hexadecimal format
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(Model 100A Manual - \$4.95)

PARATRONICS TRIGGER EXPANDER - Model 10

Adds 16 additional bits. Provides digital delay and qualification of input clock and 24-bit trigger word. — Connects direct to Model 100A for integrated unit.

Model 10 Kit - \$229.00	Baseplate — \$9.95	Model 10 Manual — \$4.95
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3 1/2-Digit Portable DMM

- Overload Protected
- 3" high LED Display
- Battery or AC operation
- Auto Zeroing
- 1mv, 1V, 0.1 ohm resolution
- Overrange reading
- 10 meg input impedance
- DC Accuracy 1% typical
- Ranges: DC Voltage - 0-1000V/AC Voltage: 0-1000V Freq. Response: 50-400 HZ DC/AC Current: 0-100mA Resistance: 0-10 meg ohm Size: 6 1/2" x 4 1/2" x 2 1/2"

Model 2800 \$99.95

Comes with test leads, operating manual and spare fuse.

Accessories:

AC Adapter BC-28	\$9.00
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Carrying Case LC-28	7.50

100 Mhz 8-Digit Counter

- 20 Hz-100 Mhz Range
- 8 LED Display
- Crystal-controlled timebase
- Fully Automatic
- Portable — completely self-contained
- Size — 1 7/8" x 7 3/8" x 5 5/8"

MAX-100 \$134.95

ACCESSORIES FOR MAX 100:

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63-Key Unencoded KEYBOARDS Hexadecimal Encoder

This is a 63-key, terminal keyboard newly manufactured by a large computer manufacturer. It is unencoded with SPST keys, unattached to any kind of PC board. A very solid molded plastic 13 x 4" base suits most applications. IN STOCK

\$29.95/each

19-key pad includes 1-10 keys, ABCDEF and 2 optional keys and a shift key. \$10.95/each

\$5.00 Minimum Order — U.S. Funds Only California Residents — Add 6% Sales Tax

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J1

The Incredible "Pennywhistle 103"

\$129.95 Kit Only

The Pennywhistle 103 is capable of recording data to and from audio tape without critical speed requirements for the recorder and it is able to communicate directly with another modern terminal for telephone "hamming" and communications for the deaf. In addition, it is free of critical adjustments and is built with non-precision, readily available parts.

Data Transmission Method Frequency-Shift Keying, full-duplex (half-duplex selectable).

Maximum Data Rate 300 Baud

Data Format Asynchronous Serial (return to mark level required between each character).

Receive Channel Frequencies 2025 Hz for space; 2225 Hz for mark.

Transmit Channel Frequencies Switch selectable: Low (normal) = 1070 space, 1270 mark; High = 025 space, 2225 mark.

Receive Sensitivity -46 dbm acoustically coupled.

Transmit Level -15 dbm nominal. Adjustable from -6 dbm to -20 dbm.

Receive Frequency Tolerance Frequency reference automatically adjusts to allow for operation between 1800 Hz and 2400 Hz.

Digital Data Interface EIA RS-232C or 20 mA current loop (receiver is optoisolated and non-polar).

Power Requirements 120 VAC, single phase, 10 Watts.

Physical All components mounted on a single 5" by 9" printed circuit board. All components included.

Requires a VOM, Audio Oscillator, Frequency Counter and/or Oscilloscope to align.

the 3rd Hand

\$9.95 each

Leaves two hands free for working

Clamps on edge of bench, table or work bench

Position board on angle or flat position for soldering or clipping

Sturdy aluminum construction for hobbyist, manufacturer or school rooms

DIGITAL STOPWATCH

- Bright 6 Digit LED Display
- Times to 99 minutes 59.99 seconds
- Crystal Controlled Time Base
- Three Stopwatches in One
- Times Single Event — Split & Taylor
- Size 4.5" x 2.15" x .90" (4 1/2 ounces)
- Uses 3 Penlite Cells.

Kit — \$39.95

Assembled — \$49.95

Heavy Duty Carry Case \$5.95

Stop Watch Chip Only (7205) \$19.95

IMC 3 1/2-DIGIT DPM KIT

1264

- New Bipolar Unit
- Auto Zeroing
- 5" LED
- Auto Polarity
- Low Power
- Single IC Unit

Model KB500 DPM Kit \$49.00

Model KB503 5V Power Kit \$17.50

JE700 CLOCK

The JE700 is a low cost digital clock, but is a very high quality unit. The unit features a simulated walnut case with dimensions of 6" x 2 1/2" x 1". It utilizes a MAN72 high brightness readout, and the MMS314 clock chip.

12 or 24 Hour

115 VAC

KIT ONLY \$16.95

JE803 PROBE

The Logic Probe is a unit which is for the most part indispensable in trouble shooting logic families TTL, DTL, RTL, CMOS. It derives the power it needs to operate directly off of the circuit under test, drawing a scant 10 mA max. It uses a MAX3 readout to indicate any of the following states by these symbols: (H) - 1 (LOW) - 0 (PULSE) - P. The Probe can detect high frequency pulses to 45 MHz. It can't be used at MOS levels or circuit damage will result.

printed circuit board

TTL 5V 1A Supply

This is a standard TTL power supply using the well known LM309K regulator IC to provide a solid 1 AMP of current at 5 volts. We try to make things easy for you by providing everything you need in one package, including the hardware for only

JE225 \$9.95 Per Kit

PROTO BOARDS

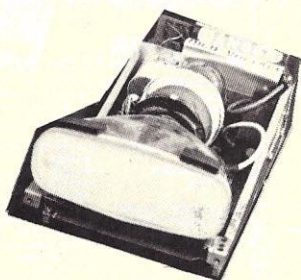
PROTO BOARD 6 \$15.95 (6" long X 4" wide)

PB100 - 4.5" x 6" \$19.95

PB101 - 5.8" x 4.5" 29.95

PB102 - 7" x 4.5" 39.95

PB103 - 9" x 6



TYPESETTING MONITOR

We have acquired an unusual video monitor. It was originally designed for and used in the photo typesetting industry. As the typesetter composed his copy, the copy would appear on the screen. The tube is a flat type about 6½" x 2¼", since only one line of copy was scanned at a time. Most of the tubes have slight burn marks, but are still usable. We have all the circuitry, and will supply the circuitry with each order. We believe most of these units are in working order, since they were taken out of service when the equipment was upgraded. Looks like a good start to make into your own video monitor at giveaway prices. We have them with and without the CR tubes. Sold as is only.

STOCK No. 5603K Typesetter monitor with tube & circuit diagrams \$22.50 ea. 2/\$40.00
STOCK No. 5604K Typesetter monitor without tube, with circuit diagrams . \$15.00 ea. 2/\$25.00

TV HOCKEY and SOCCER GAME plus VIDEOCUBE

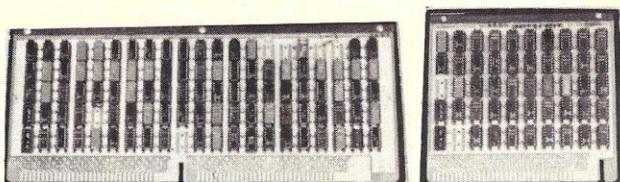


For some time we have been selling our VIDEOCUBE, the TV interface between computers, cameras, etc., and your TV set. We sold them in kit form, and to date we have sold over 3,000. We sold the complete VIDEOCUBE, when available, for \$16.95.

We now have a limited number of Hockey-Soccer Video games, complete with VIDEOCUBE interface, at a new low price of \$18.95; previously sold for \$27.50 in kit form. This gives you two games, at two levels of skill, with LED readouts for scorekeeping. This game sold in Boston department stores for \$79.50.

STOCK No. 5495K Complete VIDEO GAME & VIDEOCUBE \$18.95 ea. 2/\$35.00

WIRE WRAP BOARDS LOADED WITH 7400 SERIES ICs



Since last summer, we have been selling 2 wire wrap boards, Our Stock No. 6558K with approximately 100 sockets, and our Stock No. 6559K with approximately 45 sockets. These have been successful, based on your orders and reorders. We now have the same boards, but with the sockets still containing the original SN7400 series ICs that were used in the computer that these boards were designed for. We checked the value of these ICs, against the lowest price ICs in several Electronics magazine, and found that

at the lowest possible surplus prices, the values of the ICs on the 100 socket board ran to over \$40.00. A sample of some of the chips on the board we looked at are as follows: 74H87, 7486, 74107, 7451, 7400, 7404, 7495, 7493, 7492, 74193, 7489 and many others, to numerous to mention. Also on some boards, are a few linears, and phase locked loops. Not everyone needs every chip, but if you are working at all with TTL, this is a great opportunity to get an inventory of the most useful chips at a ridiculous price. We are selling the 100 socket board with about 100 chips, for \$10.00 more than the board itself, and the 45 socket chip for \$5.00 more than the board itself. We will also include with each board, 2 edge connectors with the 100 socket board, and 1 edge connector with the 45 socket board.

STOCK NO.6558K	75 to 100 socket board	\$18.75 ea. 2/35.00
STOCK NO.6559K	45 to 50 socket board	\$11.75 2/22.00
STOCK NO.6749K	75 to 100 socket wire wrap board with ICs and edge connectors	\$28.75 ea. 2/55.00
STOCK NO.6750K	45 to 50 socket wire wrap board with ICs and edge connector	\$16.75 ea. 2/32.00
STOCK NO.6603K	Edge connector for either board	\$ 2.00 ea 3/5.00

MORE NEW TRANSFORMERS

TRANSFORMER 1. Primary 115 V, Secondary 1, 30V @ 2 A.Secondary 2, 16.5 V @ 1.2 A. Secondary 3, 16 V @ 3.5 A. Secondary 4, 9.5 V @ 3.5 A.

STOCK NO.6677R Wt. 10 lbs. \$10.95 ea. 2/20.00

TRANSFORMER 2. Primary, 115 V. Secondary 1, 12 V. @ 5 A., Secondary 2, 24 V. @ 9 A., Secondary 3 14 V. @ 20 A. Secondary 4, 125 V. @ 1.5 A.

STOCK NO.6675K 16 lbs. 18.95 2/36.00

TRANSFORMER 3. Primary 115 V. Secondary 1, 12.6 V ct @ 1 A.Secondary 2, 33 V tapped at 13.1 V @ 1 Amp. Secondary 3, 140 V. @ 100 ma.

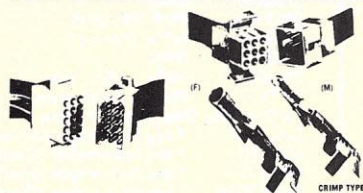
STOCK NO.6772K 2 lbs. 4 1/16"x 2 1/16"x 2 5/8". 2.95 ea. 2/5.00

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Complete Connectors		NYLON CONNECTORS		Mfg by Molex	
Per Pkg.	Type No.	Class	Description	Ea.	Pkg.
5	1625-1PRT	Min. (.062")	1 Circuit	\$1.75	
3	1625-2PRT	"	2 Circuit	1.90	
2	1625-3PRT	"	3 Circuit	2.10	
2	1625-4PRT	"	4 Circuit	2.20	
2	1625-5PRT	"	5 Circuit	2.20	
2	1625-6PRT	"	6 Circuit	2.35	
1	1649-8PRT	"	8 Circuit	1.55	
1	1625-9PRT	"	9 Circuit	1.75	
1	1625-12PRT	"	12 Circuit	1.90	
1	1625-15PRT	"	15 Circuit	2.30	
1	1625-24PRT	"	24 Circuit	3.25	
1	1772-36PRT	"	36 Circuit	4.55	
5	1619PRT	Std. (.093")	1 Circuit	1.75	
3	1545PRT	"	2 Circuit	1.90	
3	1396PRT	"	3 Circuit	2.10	
2	1490PRT	"	4 Circuit	2.10	
2	1653PRT	"	5 Circuit	2.20	
2	1261PRT	"	6 Circuit	2.35	
1	1292PRT	"	9 Circuit	1.80	
1	1360PRT	"	12 Circuit	1.90	
1	1375PRT	"	15 Circuit	2.45	

Prototype hand tools combine efficiency with economy. Ideal for prototype or limited production runs.

HT-1919 for .093" pin dia. terminals.....\$8.95 each

HT-1921 for .062" pin dia. terminals.....\$8.95 each

Econo-Extractor removes terminal from nylon connector housing with smoothness and ease.

HT-2054 for extracting .093" pin dia. terminals.....\$2.25 each

HT-2073 for extracting .062" pin dia. terminals.....\$2.25 each

Deluxe ejector tools, spring-loaded for simple, efficient removal of terminal from nylon connector housing-extracts either male or female terminals of same pin diameter.

HT-2038 for extracting .093" pin dia. terminals.....\$6.70 each

HT-1010-282 Replacement tip for HT-2038.....\$2.50 each

HT-2285 for extracting .062" pin dia. terminals.....\$6.70 each

HT-1672-3 replacement tip for HT-2285.....\$2.50 each

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555 Timer 8 pin mini-DIP	.49
741 Compensated OP-Amp 8 pin DIP	.37
LM 1889N RF Video Modulator	7.45
CA3130 Bipolar/Mos-FET Op Amp	1.19
CA3140 MOS-FET Op Amp, Bi-polar out	.99
LM3909 Lo Voltage Led Pulsar	1.50
LM3911 Temp Control CHIP	1.50
Signetics 2504TA 1024 bit S.R. memory (1404A)	\$1.75
MCM 6571P Character Generator	9.95
MCM6571AP Character Generator	\$9.95
MCM6575P Character generator	7.50
AF100-1C1 Active Filter, State Variable	2.65
LM2907N Tachometer F/V Converter	9.15
LM1812N Ultra-sonic Transceiver	5.73
LM1815 Adaptive Sense Amp for Tachometer	5.73

S25188 Hex 32 bit Shift Register.....	\$2.95
TL170 TO-92 Hall effect switch w/spec sheets	1.25
MC14409P Telephone Rotary Pulsar	10.98
MC14419P Touch Pad Converter for 14409	4.25
MC14411P Baud Rate Generator	11.98
MC14412VP CMOS Modem Chip	16.95
MM57109N Number Cruncher Micro	18.95
74C915 7 Segment to BCD Converter	2.99
74C922 16 Key Keyboard Encoder	6.35
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74C935-1 3 1/2 Digit DVM CMOS Chip	16.98
9601 Retriggerable One shot.....	.50
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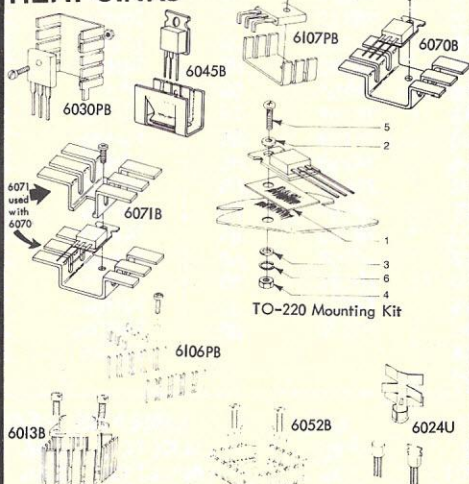
DATA ACQUISITIONS SUBSYSTEM
ADC0817 is a 40 pin CMOS I.C. with an 8-bit analog-to-digital converter, a 16 channel multiplexer and micro processor compatible control logic. Converter features high impedance chopper stabilized comparator, voltage divider with analog switch tree and a successive approximation register. Latched Tri-State outputs for easy u-procession interface. Require only 15 mW of power from single 5V supply. Fast, 100uS conversion time.
ADC0817.....(40 pin DIP).....\$29.88
Spec sheets.....\$1.00



Annie Sez,

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Economical 1 piece heat sinks for plastic power parts in TO-220 and Motorola cases 77, 90, 199, and TO-126. All are black anodized aluminum. "PB" series is anodized after forming. "PB" series is anodized prior to forming.

THM 6030PB Vertical	25c, 5/\$1.00, 10/\$1.90
THM 6045B Slip Over	30c, 4/\$1.00, 10/\$2.00
THM 6070B Extra Disipation Horiz.	35c, 3/\$1.00, 10/\$3.00
THM 6071B Top Hat for 6070	35c, 3/\$1.00, 10/\$3.00
THM 6106PB Flat With Fingers	30c, 4/\$1.00, 10/\$2.00
THM 6107PB Smaller Size Flat	25c, 5/\$1.00, 10/\$1.90
THM 6013B TO-3 Diamond	69c, 4/\$2.50, 10/\$5.00
THM 6024-U Unfinished TO-92	10/\$1.00, 100/\$5.00
THM-6052B TO-3 Square	60c, 5/\$2.50, 10/\$4.25

TO-220 6 Piece Mounting Kit - Handy Package...25c

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Molded body encloses positive screw activated clamp which will accommodate wire sizes 14-30 AWG. Contacts and pins are solder plated copper. Pins are on .200 inch (5.08mm) for standard P. C. mounting. 10Amp rating. Compare our prices before you buy.

4 pole	TS-2504	.99
8 pole	TS-2508	1.49
12 pole	TS-2512	2.19



S-100 BUS CONNECTORS (IMSAI TYPE)

Gold, Solder tail for Mother boards \$4.50, 4/\$17.00
Tin-Nickel, (NASGLO) Solder tail \$3.75, 4/\$14.00
Gold, wire-wrap.....\$4.50, 4/\$17.00
Tin-Nickel, (NASGLO) wire-wrap \$3.75, 4/\$14.00
HEX DARLINGTON ARRAY
MC1413P is a 16 pin DIP package with (6) 50V 500mA Darlington pairs.
MC1413P.....\$1.59
Specs/Apps......30c

I.C. SOCKETS

Lo Profile Tin Solder Tail Dip Sockets

8 pin	10/\$1.50	100/\$14.00	1000/\$120.00
14 pin	10/\$1.70	100/\$16.00	1000/\$140.00
16 pin	10/\$1.90	100/\$18.00	1000/\$160.00

VOLTAGE REGULATORS

7805-06-08-12-15-24 TO220	95c	5/\$4.50
7905-06-08-12-15-24 TO 220	95c	5/\$4.50
78L05A-12-15 4% 100 mA TO-92 Plastic		50c
78H05KC 5V 5A TO-3		9.15
78H12KC 12V 5A TO-3		9.15
78H15KC 15V 5A TO-3		9.15
Lm317K 1.5A Adjustable TO-3		4.99
Lm317T 1.5A Adjustable TO-220		3.99
Lm317MP .5A Adjustable TO-220		13.95
TL430C Adjustable Zener-Think About It		1.50
TL497C Switching Reg. & Inductor		9.50
RCA CA 3085 100 mA Adjustable		.60

ADJUSTABLE NEGATIVE REGULATOR

LM337 is the complement to the popular LM317 positive adjustable regulator. Capable of 1.5Amp from -1.2V to -37V.
LM337K.....(TO-3 Metal).....\$5.99
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Specs and applications.....60c

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IN4148 Hi Speed Signal	15/\$1.00 100/\$5.00
D-600 115 V, 100 mA Hi Speed Signal	20/\$1.00
D2131 200 V, 25A Stud	85c
D2135 400 V, 25A Stud	1.00
D2138 600 V, 25A Stud	1.55
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100V 2.5 WATT ZENER	
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2N4036 90V, 1A PNP Silicon TO-5	.50
2N6101 80V, 10A NON HI GAIN TO-220	.50
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12V, 1A Transformer with 6' Power Cord	2.88



Jumper Kits for .025 Square Posts.
All material for making jumpers for quick circuit changes and prototyping. Use for breadboarding, trouble shooting, field modifications. Fits standard IC socket wire/wrap posts. Excellent wiping action on gold plated box contacts. Kit contain 10 box contacts, heat shrinkable sleeving, and 5 feet of wire plus instruction sheet.
JCK-5101....(5 double jumpers)\$2.75, 4 kits/\$10.00

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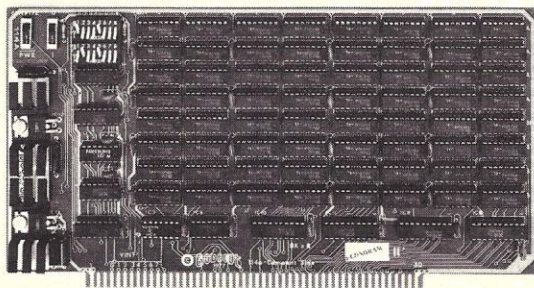
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1N914	100v	10mA	.05	8-pin	pcb	.25	ww	.45	2N2222A	NPN (2N2222 Plastic .10)	.15
1N4005	600v	1A	.08	14-pin	pcb	.25	ww	.40	2N2907A	PNP	.15
1N4007	1000v	1A	.15	16-pin	pcb	.25	ww	.40	2N3906	PNP (Plastic)	.10
1N4148	75v	10mA	.05	18-pin	pcb	.25	ww	.75	2N3904	NPN (Plastic)	.10
1N753A	6.2v	z	.25	22-pin	pcb	.45	ww	1.25	2N3054	NPN	.35
1N758A	10v	z	.25	24-pin	pcb	.35	ww	1.10	2N3055	NPN 15A 60v	.50
1N759A	12v	z	.25	28-pin	pcb	.35	ww	1.45	T1P125	PNP Darlington	.35
1N4733	5.1v	z	.25	40-pin	pcb	.50	ww	1.25	LED Green, Red, Clear, Yellow		
1N5243	13v	z	.25	Molex pins .01		To-3 Sockets		.45	D.L.747	7 seg 5/8" High com-anode	1.95
1N5244B	14v	z	.25	2 Amp Bridge		100-prv		1.20	XAN72	7 seg com-anode (Red)	1.25
1N5245B	15v	z	.25	25 Amp Bridge		200-prv		1.95	MAN71	7 seg com-anode (Red)	1.25
									MAN3610	7 seg com-anode (Orange)	1.25
									MAN82A	7 seg com-anode (Yellow)	1.25
									MAN74A	7 seg com-cathode (Red)	1.50
									FND359	7 seg com-cathode (Red)	1.25
C MOS				- T T L -							
4000	.15	7400	.15	7473	.25	74176	1.25	74H72	.45	74S133	.40
4001	.15	7401	.15	7474	.30	74180	.75	74H101	.75	74S140	.55
4002	.20	7402	.20	7475	.35	74181	2.25	74H103	.75	74S151	.30
4004	3.95	7403	.20	7476	.40	74182	.95	74H106	.95	74S153	.35
4006	.95	7404	.15	7480	.55	74190	1.75			74S157	.75
4007	.35	7405	.25	7481	.75	74191	1.05	74L00	.25	74S158	.30
4008	.95	7406	.35	7483	.95	74192	.75	74L02	.25	74S194	1.05
4009	.45	7407	.55	7485	.75	74193	.85	74L03	.30	74S257 (8123)	1.05
4010	.45	7408	.25	7486	.25	74194	1.25	74L04	.30		
4011	.20	7409	.15	7489	1.35	74195	.95	74L10	.30	74LS00	.25
4012	.20	7410	.10	7490	.55	74196	1.25	74L20	.35	74LS01	.35
4013	.40	7411	.25	7491	.95	74197	1.25	74L30	.45	74LS02	.35
4014	.95	7412	.30	7492	.95	74198	2.35	74L47	1.95	74LS04	.30
4015	.90	7413	.35	7493	.35	74221	1.00	74L51	.45	74LS05	.45
4016	.35	7414	1.10	7494	.75	74367	.85	74L55	.65	74LS08	.25
4017	1.10	7416	.25	7495	.60			74L72	.45	74LS09	.35
4018	1.10	7417	.40	7496	.80	75108A	.35	74L73	.40	74LS10	.35
4019	.50	7420	.15	74100	1.15	75110	.35	74L74	.45	74LS11	.35
4020	.85	7426	.30	74107	.35	75491	.50	74L75	.55	74LS20	.25
4021	1.00	7427	.45	74121	.35	75492	.50	74L93	.55	74LS21	.25
4022	.85	7430	.15	74122	.55			74L123	.85	74LS22	.25
4023	.25	7432	.30	74123	.55	74H00	.15			74LS32	.40
4024	.75	7437	.30	74125	.45	74H01	.25	74S00	.35	74LS37	.35
4025	.30	7438	.35	74126	.35	74H04	.20	74S02	.35	74LS40	.45
4026	1.95	7440	.25	74132	1.35	74H05	.20	74S03	.30	74LS42	1.10
4027	.50	7441	1.15	74141	.90	74H08	.35	74S04	.30	74LS51	.50
4028	.95	7442	.45	74150	.85	74H10	.35	74S05	.35	74LS74	.65
4030	.35	7443	.65	74151	.65	74H11	.35	74S08	.35	74LS86	.65
4033	1.50	7444	.45	74153	.75	74H15	.45	74S10	.35	74LS90	.95
4034	2.45	7445	.65	74154	.95	74H20	.30	74S11	.35	74LS93	.95
4035	1.25	7446	.95	74156	.95	74H21	.25	74S20	.35	74LS107	.85
4040	1.35	7447	.95	74157	.65	74H22	.40	74S40	.20	74LS123	1.00
4041	.69	7448	.65	74161	.85	74H30	.20	74S50	.20	74LS151	.95
4042	.95	7450	.25	74163	.85	74H40	.25	74S51	.25	74LS153	1.20
4043	.95	7451	.25	74164	.60	74H50	.25	74S64	.20	74LS157	.85
4044	.95	7453	.20	74165	1.50	74H51	.25	74S74	.35	74LS164	1.90
4046	1.75	7454	.25	74166	1.35	74H52	.15	74S112	.60	74LS367	.75
4049	.45	7460	.40	74175	.80	74H53J	.25	74S114	.65	74LS368	.75
4050	.45	7470	.45			74H55	.20			74C04	.25
4066	.95	7472	.40							74C151	2.25
4069	.40										
4071	.35										
4081	.70										
4082	.45										
MC 14409	14.50										
MC 14419	4.85										
9000 SERIES											
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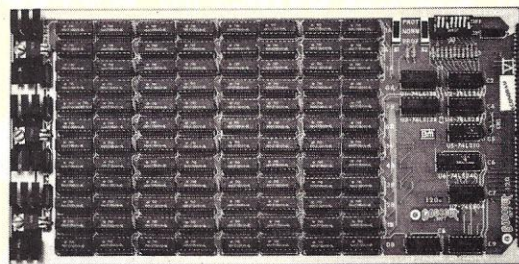


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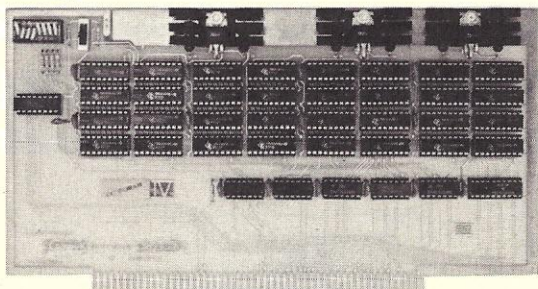
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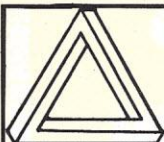
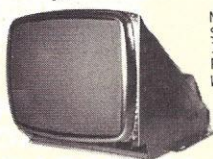
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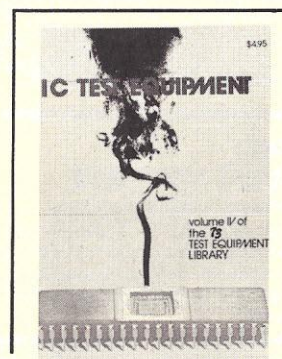
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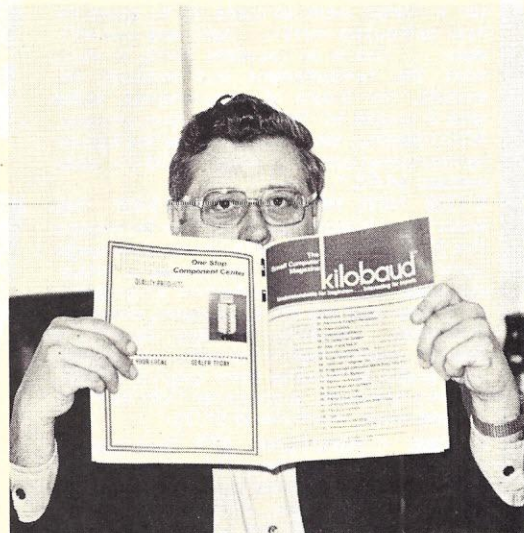
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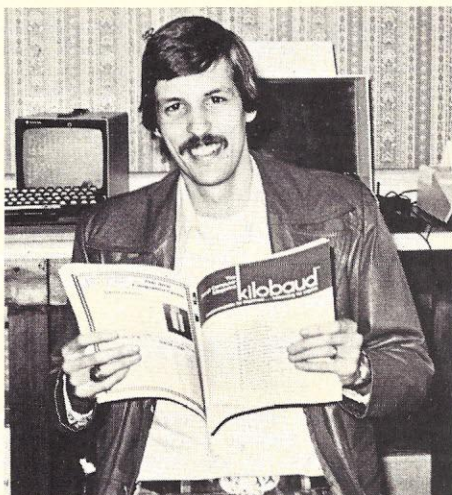
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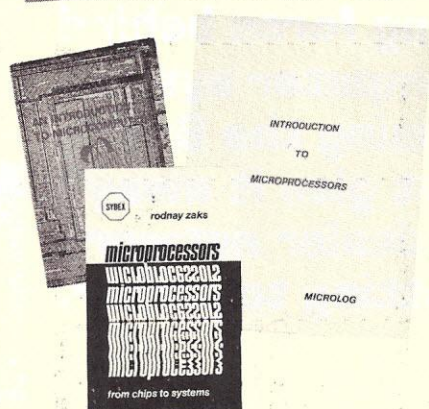
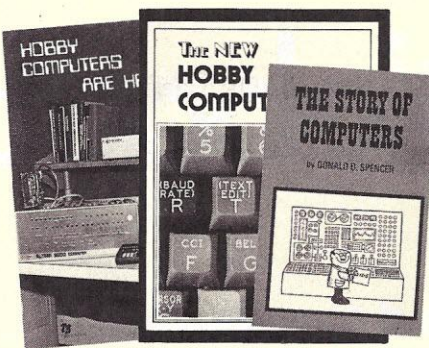
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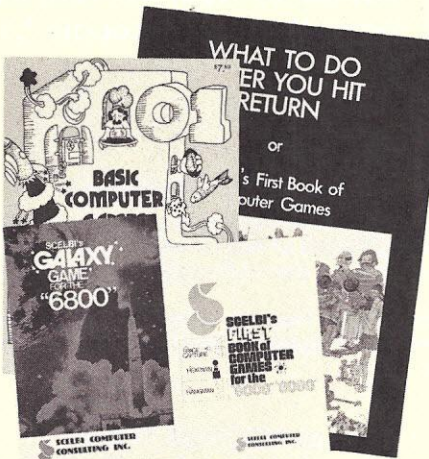
● **HOME COMPUTERS: A BEGINNERS GLOSSARY AND GUIDE** this book is intended as a quick reference source for beginners. Included is a general introduction to microcomputers, a simple application & sample system, the history of microcomputers & their uses, and an introduction to some actual equipment. A chapter on number systems includes a number conversion chart, binary arithmetic from conversions to divisions, and a discussion of octal and hexadecimal numbers. A good background to read technical literature and computer equipment specifications. \$6.95.*

computer games

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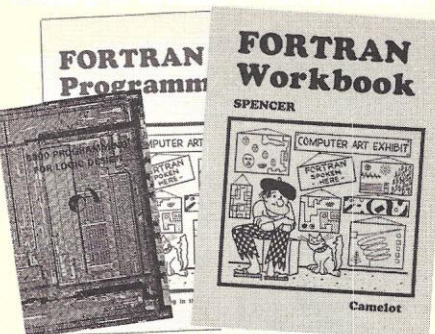
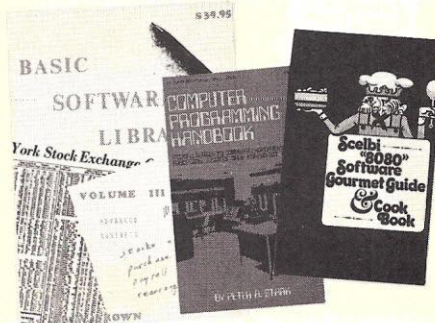
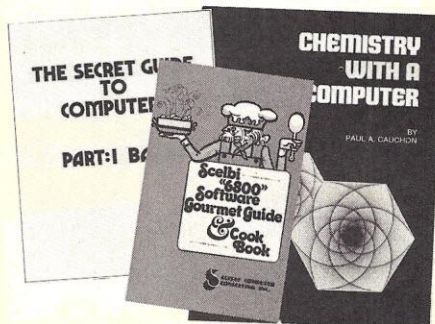
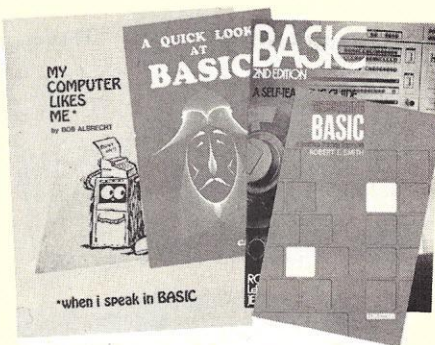
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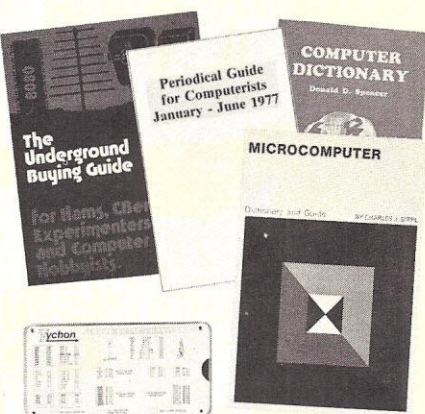
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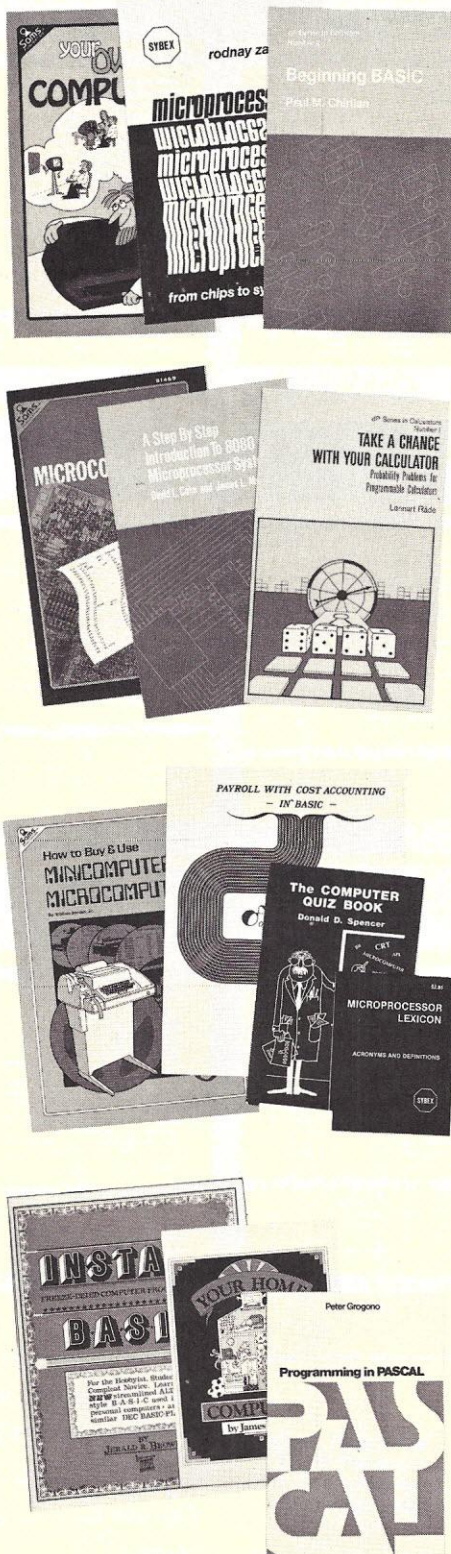
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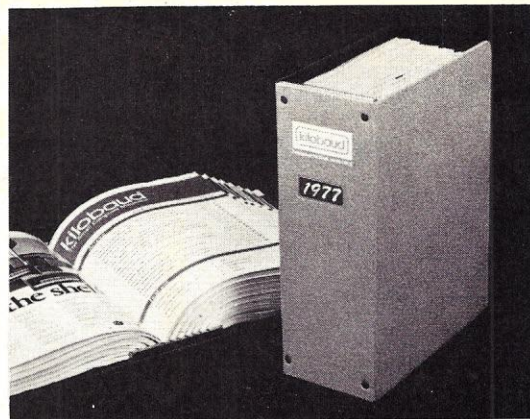
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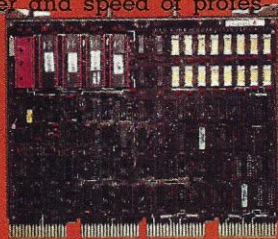
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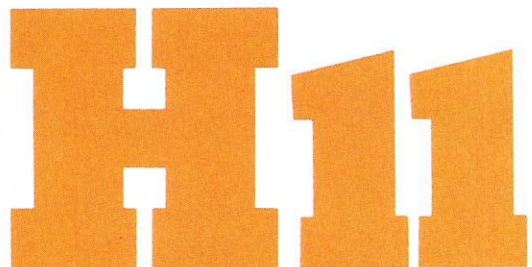
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